RUBBER WORLD

OUR

66th YEAR

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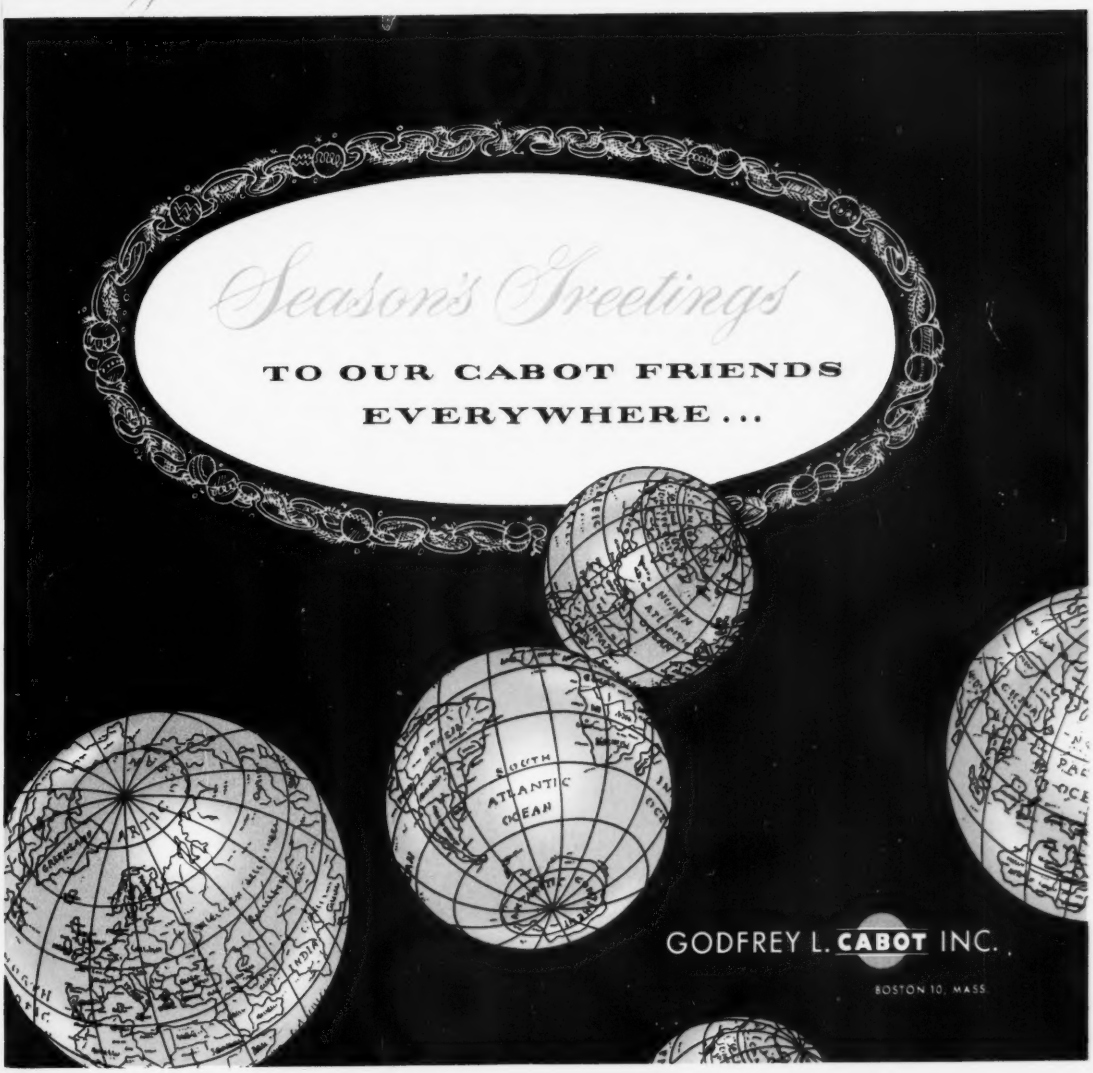
DECEMBER, 1954



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The new name for Du Pont fine silica technical

VALRON* *Estersil*

A finely divided surface-esterified amorphous silica for reinforcement of elastomers

PROPERTIES

Specific Gravity	1.86
Silica	86 to 89%
Surface Area	310±25 M^2/gm
Ultimate Particle Size	8-10 mu
Bulk Density	16-20 lb/ft^3
Physical Form	Easily crushable pellets

Disperses readily
Non-dusting

VALRON* *is an outstanding reinforcing agent for Silicone Rubber Gums*

COMPOUND BASIS	OPTIMUM REINFORCEMENTS ATTAINED	
Methyl Silicone Gums	Tensile Strength	1800 psi
	Tear Resistance	300 lb/in
Methyl-Phenyl Silicone Gums	Tensile Strength	1600 psi
	Tear Resistance	250 lb/in

"VALRON," now in pilot plant production, is available for laboratory testing and product development. The properties of "Valron" and its uses are fully described in Report 54-4, released with our November 1954 "NEWS about Du Pont Rubber Chemicals." Our district offices will be glad to assist you in developing silicone rubber stocks containing "Valron."

*TRADE-MARK

DISTRICT OFFICES:

Akron 8, Ohio, 40 E. Buchtel Ave.....POrtage 2-8461
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DU PONT RUBBER CHEMICALS

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

RUBBER WORLD, December, 1954, Vol. 131, No. 3. Published monthly by BILL BROTHERS PUBLISHING CORP. Office of Publication, 1309 Noble Street, Philadelphia, Pa., with Editorial and Executive Offices at 386 Fourth Avenue, New York 16, N. Y., U.S.A. Entered as Second Class Matter at the Post Office at Philadelphia, Pa., under the act of March 3, 1879. Subscription United States $5.00 per year; Canada, $6.00; All other countries $7.00; Single Copies, 50 cents. Address Mail to N. Y. Office.

Another new development using

B. F. Goodrich Chemical *raw materials*

Cutaway view of Victor K-4 molded seal showing unique design.

K-4 oil seals, made by Victor Manufacturing & Gasket Co., are installed on International Harvester trucks. B. F. Goodrich Chemical Company supplies only the Hycar rubber.

TRUCK SLOSHES THROUGH WATER SAFELY ...with Hycar bearing seals

THIS truck's front wheel bearings are fully protected from the water and dirt of this big puddle by seals made of Hycar rubber. And just as vital a function—the Hycar bearing seals keep grease in!

This double protection means double savings. These Victor seals made of Hycar assure the long life and efficiency of the wheel bearings. Costly repairs are eliminated because the bearings cannot run dry and foreign matter cannot score their highly polished surfaces.

Hycar rubber is used in many sealing applications – for trucks, passenger cars, tractors and home appliances. Hycar is highly resistant to abrasion and maintains a tight seal under severe operating conditions and a wide temperature range.

Parts made of Hycar can be molded to close tolerances. And—Hycar's resistance to oil, grease and most chemicals makes it ideal for many uses in many industries.

Perhaps Hycar can solve a problem for you—do a job that you thought couldn't be done. We'll help you find the answers—give you technical advice. For information, please write Dept. HA-12. B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B. F. Goodrich Chemical Company
A Division of The B. F. Goodrich Company

Hycar
Reg. U. S. Pat. Off.
American Rubber

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON colors

40 bags, or 2,000 pounds, of Philblack is stacked on each of the three pallets above. Note the savings in cubage realized by Philblack's firm, rectilinear flat and shaped bags over round bags previously used.

Philblack* bags

How would you like to have 25% more Philblack storage space in your warehouse?

Well – more efficient storage is just one advantage of our new ***flat*** and ***shaped*** Philblack bags.

As you might guess, carbon black is inherently difficult to package. Its low specific density and small particle size combine to defy gravity and the best intentions of packaging machines. So our conventional ***round*** Philblack bag (above, left) is an achievement of sorts even though it has all the sex appeal of a sack of ripe cantaloupe.

Step by step we have sweated out improvements in our Philblack bag. We've nipped it in around the waist. We've filled it out around the shoulders and bottom. Now we're able to offer you our new flat bags (above, center). Philblack in flat bags stacks easily and firmly and saves a lot of space.

But why pay to store and transport occluded air? By pressing our flat bags, we compact them still more (above, right). Philblack in shaped bags saves the most space for you.

All four Philblacks are now packaged in both flat bags and shaped bags. You pay your money and take your choice. And, of course, bulk Philblack is available in hopper cars.

We are always ready to assist you with complete technical service on rubber compounding problems.

*A TRADEMARK

Know the Philblacks!

KNOW WHAT THEY'LL DO FOR YOU!

A **Philblack A FEF Fast Extrusion Furnace**
Ideal for smooth tubing, accurate molding, satiny finish. Mixes easily. High, hot tensile. Disperses heat. Non-staining.

I **Philblack I ISAF Intermediate Super Abrasion Furnace**
Superior abrasion resistance at moderate cost. Very high resistance to cuts and cracks. More tread miles at high speeds.

O **Philblack O HAF High Abrasion Furnace**
For long, durable life. Good electrical conductivity. Excellent flex. Fine dispersion.

E **Philblack E SAF Super Abrasion Furnace**
Toughest black on the market. Extreme abrasion resistance. Withstands aging, cracking, cutting and chipping.

Phillips 66

PHILLIPS CHEMICAL COMPANY, Philblack Sales, 318 Water Street, Akron 8, Ohio. Export Sales: 80 Broadway, New York 5, N. Y. West Coast: Harwick Standard Chemical Company, Los Angeles, California. Canada: H. L. Blachford, Ltd., Montreal and Toronto.

COLUMBIA-SOUTHERN

calcene nc

FOR SUPERIOR

WHITENESS

AND

ECONOMY

Calcene NC is a development by Columbia-Southern to meet a need in the rubber industry for a white reinforcing calcium carbonate pigment at a moderate price.

Hunter Reflectometer tests show Calcene NC to be of excellent white color as compared with similar pigments, and of special value as a reinforcement for white or light pastel molded goods and sundries.

Thorough testing of competitive materials clearly indicates Calcene NC as the most economical of the fine-particle calcium carbonates at equivalent property levels.

In a straight mill mix, Calcene NC disperses easily and will show no variation where masterbatching techniques are used. In some cases, it may be possible by switching to Calcene NC to eliminate the masterbatching step and still obtain a high level of properties.

Columbia-Southern will be glad to supply samples of Calcene NC for your experimental purposes. Also, you are invited to make use of the services of Columbia-Southern's technical staff to help you with any of your problems involving Calcene NC, Calcene TM, Silene EF and Hi-Sil. Write, wire, or telephone us at the address below.

CALCENE NC is a non-coated, fine-particle, precipitated calcium carbonate. It is similar to Calcene TM in both physical and chemical properties except that it is non-coated.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION

SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY

EXECUTIVE OFFICES: ONE GATEWAY CENTER, PITTSBURGH 22, PA. • *DISTRICT OFFICES:* BOSTON • CHARLOTTE • CHICAGO • CINCINNATI CLEVELAND • DALLAS • HOUSTON • MINNEAPOLIS • NEW ORLEANS • NEW YORK • PHILADELPHIA • PITTSBURGH • ST. LOUIS • SAN FRANCISCO

VERSATILE VINYL FOAM

is easier made with PLIOVIC

Uniformity, good foaming characteristics, a desirable fusion temperature, good heat and light stability, compatibility with modifying materials—all of which add up to ease of compounding—are the reasons for the use of PLIOVIC in IC Vynafoam.

PLIOVIC is the easy-processing vinyl resin by Goodyear. IC Vynafoam is Interchemical's name for a new series of heat-expandable plastisols that is finding application as a gasketing, insulating and cushioning material in a wide range of shapes and sizes.

Here's how it works: The initial form is a wet paste which can be poured, extruded, sprayed or cast into place. When subjected to a few minutes' heat —300-350° F.—at atmospheric pressure, the paste expands 300%-400%—then solidifies into an evenly textured foam. This foam is tough, adherent, light in weight, has good insulation and compressive properties and is resistant to oils, greases, solvents, alkalies and most acids.

Heat-expandable plastisols is just one of many uses for versatile PLIOVIC. Careful control of particle size, shape and distribution has led to the development of a whole family of resins of constant characteristics designed to help you to new or improved products, easily and economically.

Why not help yourself to more profits with PLIOVIC? Generous sample plus full technical help are yours by writing to:

Goodyear, Chemical Division,
Akron 16, Ohio

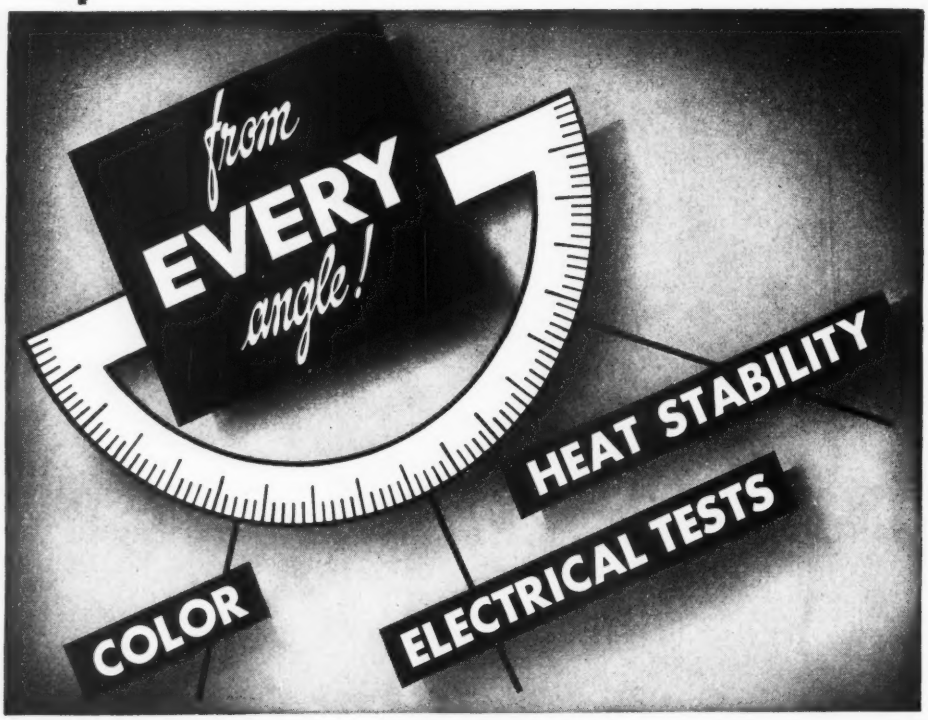
CHEMICAL
GOODYEAR
DIVISION

Use-Proved Products – CHEMIGUM • PLIOBOND • PLIOLITE • PLIO-TUF • PLIOVIC WING-CHEMICALS – The Finest Chemicals for Industry

Chemigum, Pliobond, Pliolite, Plio-Tuf, Pliovic—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio
IC Vynafoam—T. M. Interchemical Corporation, New York, N. Y.

50% HIGHER PRODUCTION of a better product with one operator instead of three in much less floor space and at a 38% savings in over-all costs — all this resulted from using IC Vynafoam, based on PLIOVIC, for gasketing on refrigerator access doors.

Photograph courtesy American Motors Corporation, Plant Five, and Interchemical Corporation.



PIGMENT NO. 33

for Compounding

VINYLS AND SYNTHETIC RUBBER

Sample and technical data sent promptly on request

SOUTHERN CLAYS, Inc.

33 RECTOR STREET
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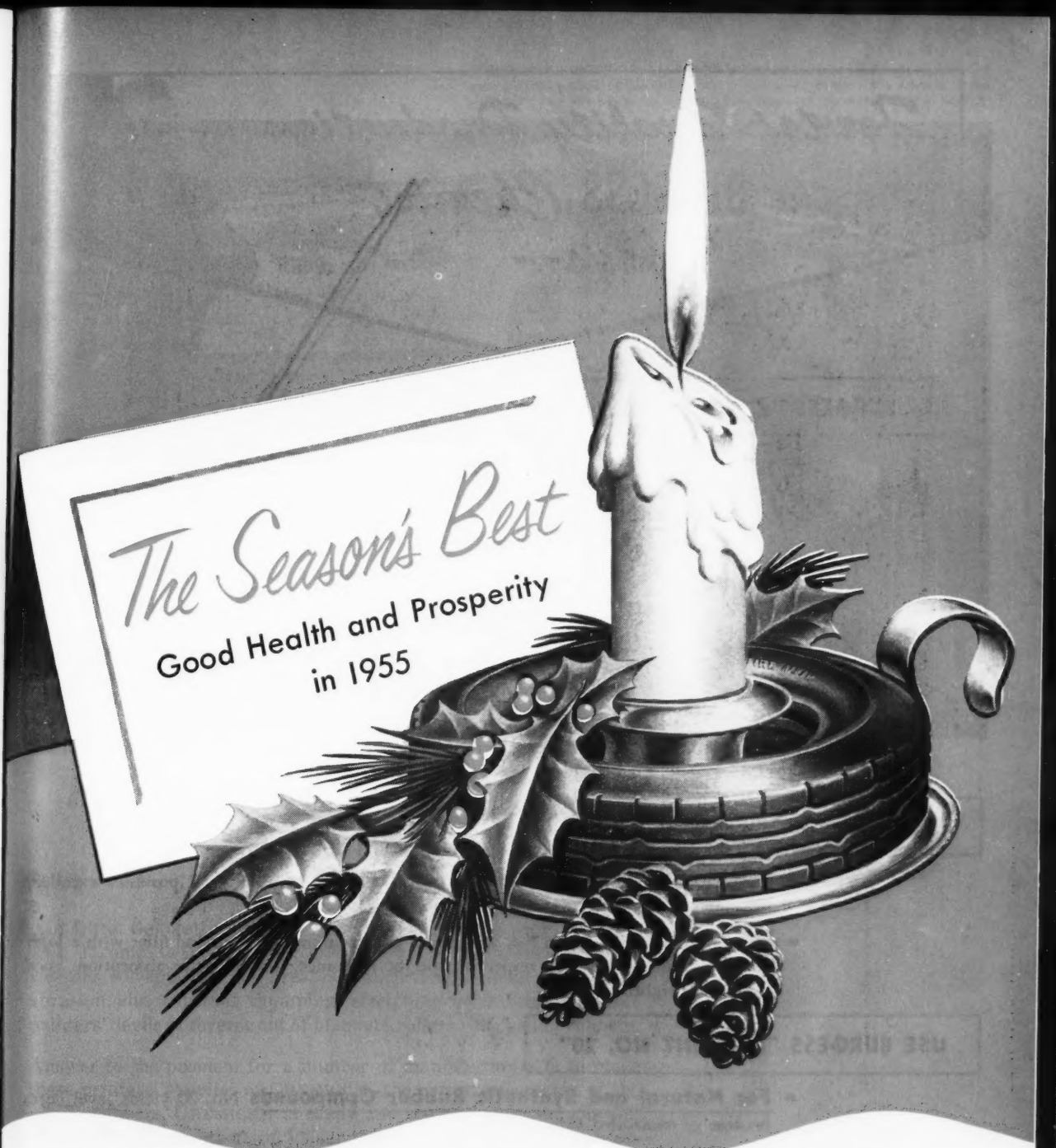

H. MUEHLSTEIN & CO. INC.

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CRUDE RUBBER · SYNTHETIC RUBBER · SCRAP RUBBER · HARD RUBBER DUST · PLASTIC SCRAP

For top Quality Production the BURGESS *Chemist says--*

USE BURGESS "ICEBERG" PIGMENT

- **For Vinyl Extrusion Compounds and Vinyl Floor Covering Compounds** "Iceberg" provides excellent base color as a white mineral loading, excellent resistance to alkalis and acids, high specific resistance with low moisture absorption properties.
- **For Butyl Wire and Insulating Compounds** "Iceberg" possesses excellent processing, reinforcing, and good electrical properties.
- **For Colored Butyl Inner Tubes, Drug Sundries and Mechanical Goods** "Iceberg" possesses excellent color, processing and curing properties and low moisture absorption.
- **For GR-S Compounding** "Iceberg" is useful in compounds requiring good white filler with good processing properties, i.e., "Iceberg" prevents stickiness on the mill and also prevents die-plating of extrusion compounds.

USE BURGESS "PIGMENT NO. 30"

- **For Vinyl Insulating and Electrical Compounds** No. 30 possesses excellent color and yields high insulation resistance values.
- **For GR-S Compounds** No. 30 acts as a good reinforcing agent and filler with a high degree of uniformity with respect to specific resistance, low moisture absorption, good color and brightness.

USE BURGESS "PIGMENT NO. 20"

- **For Natural and Synthetic Rubber Compounds** No. 20 yields level cures because of controlled pH.
- **For Rubber Footwear Compounds** No. 20 possesses excellent reinforcing characteristics and good color.

Ask Your Burgess representative for technical data, working samples, and prices.

Burgess Pigment COMPANY

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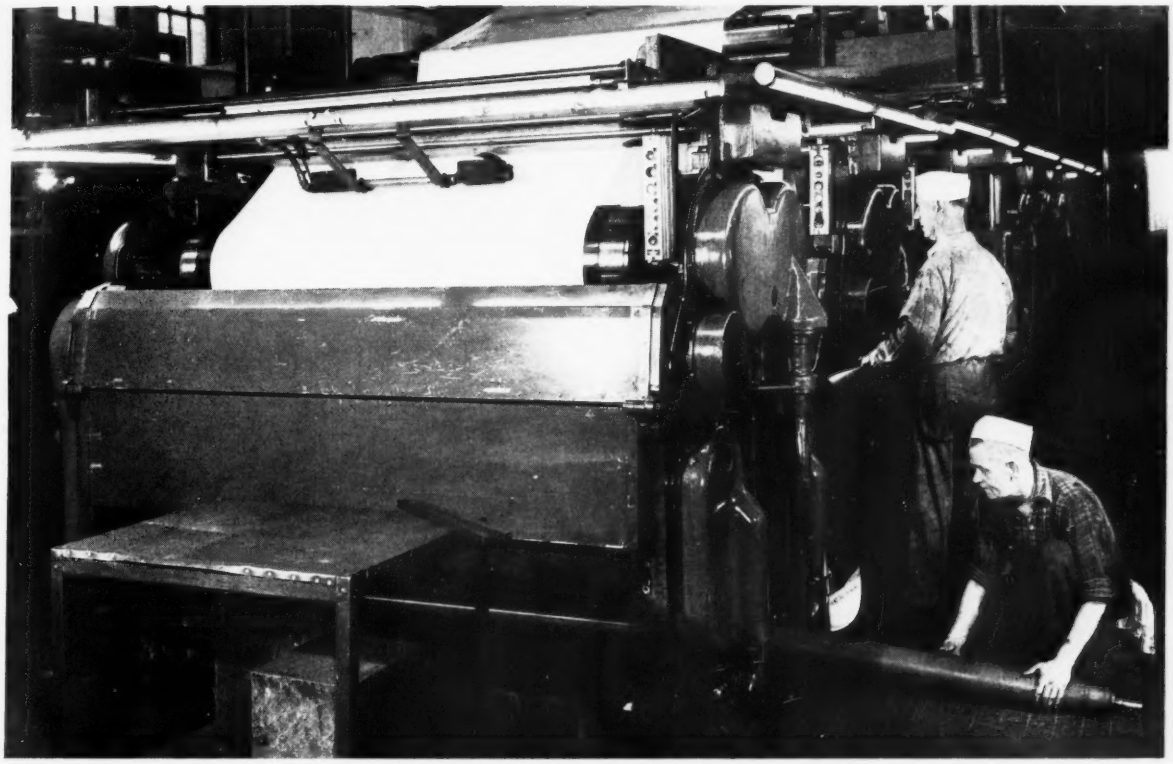
- HYDROUS AND ANHYDROUS ALUMINUM SILICATE PIGMENTS
- KAOLIN CLAYS

BEST "DRESS" FOR ANY PRESS are those press blankets, rollers and cutting rubbers made of CHEMIGUM—first, now finest, of the nitrile rubbers. These vital parts help the printer to meet his deadlines with the highest-quality printing.



MAKE YOUR BEST IMPRESSION

with printers' supplies made of CHEMIGUM

MAKING the best impression in print can be a real problem, when it comes to the rubber accessories on a press. Powerful ink and cleaning solvents, oils and greases, a surprising amount of heat and abrasion plus constant thumping, stretching or flexing can make printers' devils in reverse out of blankets, rollers and cutting rubbers.

Answer to the problem for a number of manufacturers is to make these printers' supplies of CHEMIGUM—the easiest-processing of the nitrile rubbers. CHEMIGUM is easily and economically compounded into faster-curing, stronger, longer-wearing, heat-, oil- and solvent-resistant products that give the printer sharp, clean impressions and much longer mileage.

If you are faced with problems in turning out oil-resistant rubber goods on time, on "spec" and at a profit, why not check into CHEMIGUM—product of one of the first and foremost manufacturers of synthetic rubbers and related resins. Details, samples and technical help are yours by writing to:

Goodyear, Chemical Division, Akron 16, Ohio

CHEMICAL GOODYEAR DIVISION

Chemigum, Pliobond, Pliolite, Plio-Tuf, Pliovic—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

Use-Proved Products — CHEMIGUM • PLIOBOND • PLIOLITE • PLIO-TUF • PLIOVIC • WING-CHEMICALS — The Finest Chemicals for Industry

How to Lower Vinyl Compounding Costs

Chlorowax* 40 and Surfex* MM can be used separately or in combination to lower vinyl compounding costs and increase batch yields with no sacrifice in quality. Chlorowax 40 is DIAMOND ALKALI's liquid chlorinated paraffin which has gained wide acceptance as a low-cost co-plasticizer. Surfex MM is one of DIAMOND's precipitated calcium carbonates—a filler of high uniformity and purity.

The table below shows how these DIAMOND Chemical products can be used to produce two-way savings. Your nearby DIAMOND Sales Office can show you other moneysaving formulas and supply detailed cost comparisons, or write DIAMOND ALKALI CO., 300 Union Commerce Building, Cleveland 14, Ohio. **

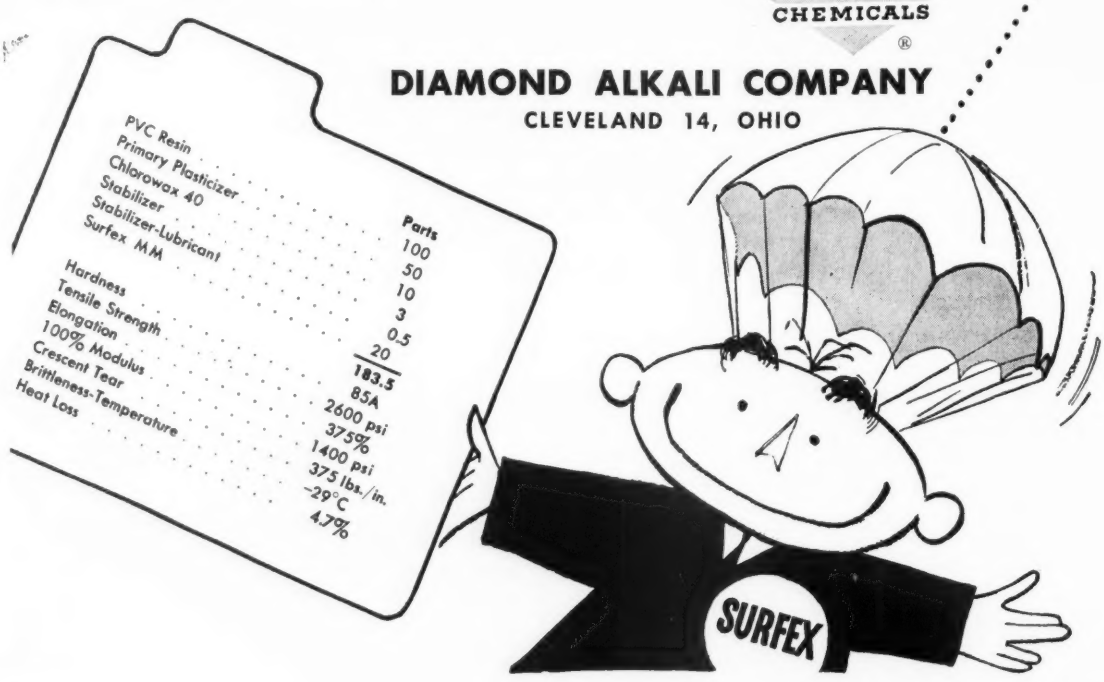
DIAMOND SALES OFFICES:
New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis, Houston.

DIAMOND DISTRIBUTORS:
C. L. Duncan Co., San Francisco and Los Angeles; Van Waters and Rogers, Inc., Seattle and Portland, U.S.A.; Harrisons & Crosfield (Canada) Ltd.

TRY THIS RECIPE FOR LOWER COST VINYL COMPOUNDS

DIAMOND ALKALI CHEMICALS ®

DIAMOND ALKALI COMPANY
CLEVELAND 14, OHIO



RELIABLE ZINC OXIDES

AZO-ZZZ-44 and AZO-ZZZ-55 assure good dispersion and easy processing because of their uniform particle size and absence of extreme fines. With AZO-ZZZ-11, 22, 33, (Acicular types) and special grades, a complete range of zinc oxides is offered for every rubber requirement.

A RELIABLE SOURCE

American Zinc assures an uninterrupted supply of zinc oxide. Recent discovery and development of a new, large ore body, added to previous American Zinc reserves, provides sufficient ore to last many years at the current rate of production.

AZO **ZZZ-44**
ZZZ-55

AMERICAN ZINC SALES COMPANY

distributors for

AMERICAN ZINC, LEAD & SMELTING COMPANY

COLUMBUS, OHIO • CHICAGO • ST. LOUIS • NEW YORK

Thiokol®

PLASTICIZER TP-90 B

Yields Maximum Low Temperature Flexibility and Maintains Excellent Physical Properties

"Thiokol" Plasticizer TP-90 B is an efficient low temperature plasticizer. Even at high concentrations it does not appreciably impair the physical properties of the compounds in which it is used.

"Thiokol" Plasticizer TP-90 B is highly compatible with natural rubber, Neoprene, nitrile-type rubbers and GR-S. It imparts excellent low temperature flexibility to these elastomers and maintains high resilience over a wide temperature range.

The following results illustrate how "Thiokol" TP-90 B yields excellent low temperature flexibilities while still maintaining the physical properties:

	Natural Rubber	Neoprene GN	Hycar OR-15	Paracril-B	GR-S
TP-90B, p. h. r.	30	20	30	30	30
Cure, min. /° F.	30/310	45/300	30/310	30/310	30/310
Tensile, p. s. i.	2200	2600	2380	2250	1500
Elongation, %	530	410	300	350	380
Shore Durometer	42	68	70	61	45
Low Temperature Flexibility**	**–95°F**	**–70°F**	**–70°F**	**–80°F**	**–95°F**

**Determined according to a modification of ASTM method D 1043-49T. The temperatures shown are the values at which the absolute torsional moduli are 10,000 p. s. i. Although the specimens were still quite flexible, G10,000 was arbitrarily chosen as the stiffening point.

For technical information and samples, write:

This information is believed to be accurate. However, no warranty is expressed or implied regarding the accuracy of these data, or the use of this product.

Thiokol Chemical Corporation

SYNTHETIC RUBBERS • PLASTICIZERS • CHEMICALS • SOLID PROPELLANTS

784 NORTH CLINTON AVENUE • TRENTON 7, NEW JERSEY

In Canada: Naugatuck Chemicals Division, Dominion Rubber Company, Elmira, Ontario

For WHITE SIDEWALLS that STAY white!

Use "non-staining" BUFFALO RECLAIMS in your tires

The trend is definitely to more and more white sidewall tires for today's modern cars. The only trouble is that, as a manufacturer, you have to face up to higher costs all along the line. That's when new improved Buffalo Reclaims can help you out of plenty of production problems.

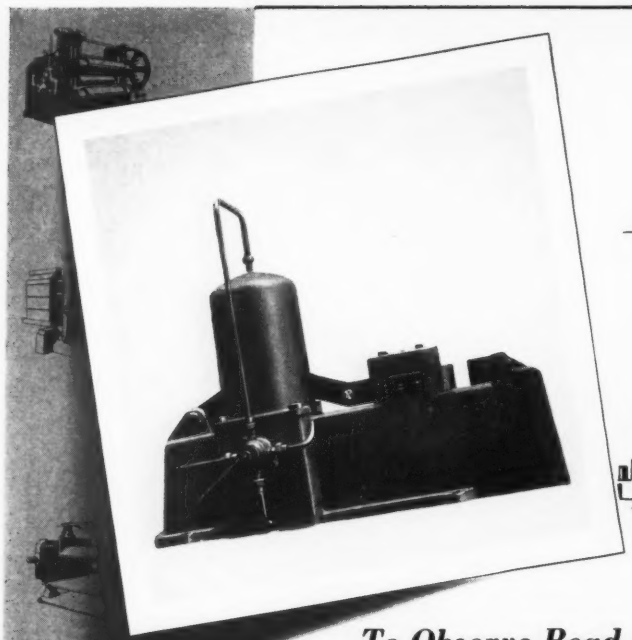
For instance, our new #220 can help you produce a BETTER white sidewall tire at a reasonable cost. As you well know, when ordinary reclaims are used, a "bleeding" process many times "stains" the white sidewall even before your dealer can sell it. We've licked that bugaboo with conventional process #220 . . . a specially developed reclaim that completely eliminates this nightmare for manufacturers.

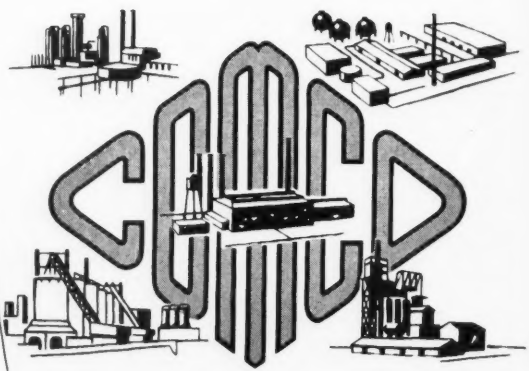
In addition, we also have Reclaimator Process Reclaim #R-400 with the same characteristics. Drop us a line now, for the latest report!

Always keep reclaims in your formula and always look to Buffalo for the best. U. S. Rubber Reclaiming Company, Inc., P. O. Box. 365, Buffalo 5, N. Y. Trenton agent: H. M. Royal, Inc., 689 Pennington Ave., Trenton, N. J.

71 years serving the industry solely as reclaimers

U.S. RUBBER RECLAIMING COMPANY, INC.





To Observe Bead Construction and Prepare Clean Tire Sections For Your Dealers

USE OUR HEAVY DUTY BEAD CUTTER!

The machine illustrated operates on 150 to 225 lbs. air pressure. It will effortlessly and cleanly cut all types of beads including the heaviest triple cable types. Both the fixed cutter in the anvil and also the moving chisel are made of high-speed steel. The chisel is mounted in a holder which operates in massive guides. The aircylinder and the toggle system move it towards the anvil. The machine will cut 600 beads in eight hours.

If you are in need of a machine or an item of special equipment, if you intend expanding your facilities or plan entering new fields of manufacture, consult us first. We supply all types of machinery and equipment for every requirement of large and small factories.

Integrated Service provides complete design, layout and construction supervision for rubber, plastics and chemical plants, process engineering, technical service and raw material sources.

Continental Machinery Company, Inc.

AND

ASSOCIATED ENGINEERS AND ARCHITECTS

261 BROADWAY, NEW YORK 7, N. Y.

TELEPHONE: WORTH 2-1650 • CABLE: "CONTIMAC" NEW YORK

Really holds together!

TY·PLY "UP" and "RC"

For Versatility in Bonding All Types of Natural Rubber and GR-S Compounds to Metal

Very suitable for natural rubber stocks (both normal and low-sulfur), standard and cold-polymerized GR-S's, polybutadiene, oil-modified GR-S, arctic-type GR-S and natural GR-S blends. Both adhesives have excellent shelf and working stability; are insensitive to weather or ozone conditions; and work well over a wide range of curing temperatures.

TY·PLY (Q) or (3640) for bonding Natural, GR-S, and Butyl

TY·PLY (S) for bonding Neoprene

TY·PLY (BN) for bonding N-types

TY·PLY will adhere most vulcanizable rubber compounds to almost any clean metal surface

Marbon

MARBON CORP.

GARY, INDIANA

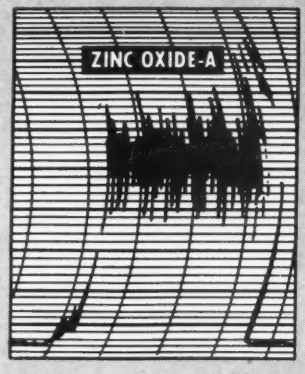
SUBSIDIARY OF BORG-WARNER

TY·PLY has stood the test of time . . . since '39

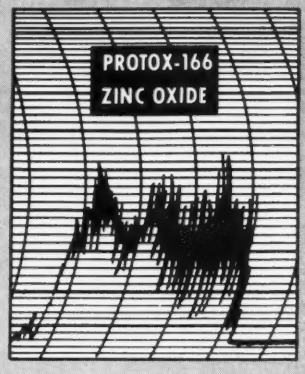
Save on Power Costs Cut Mixing Time with . . .

PROTOX* *Zinc Oxides*

POWER CONSUMPTION CHARTS OF BUNA-N MASTERBATCHES



Conventional zinc oxide resists wetting by Buna-N and other high-Mooney polymers.



Protox-166 definitely plasticizes Buna-N and provides easier-processing stocks.

These wattmeter records, made on our laboratory Banbury, show how Protox oxides cut power costs of zinc masterbatching and shorten mixing time as compared with conventional oxides:

1. Protox oxides eliminate Banbury power peaks. Rubber's affinity for the coated Protox surfaces does away with power surges — thus cutting penalty payments for electricity beyond the contract demand limit.

2. Protox oxides use less power per batch. Their patented coating of zinc propionate plasticizes the rubber . . . makes mixing easier.

3. Protox oxides shorten mixing time. They have fewer aggregates . . . the latter are dispersed by our exclusive process——treatment with propionic acid.

These are only a few of the ways you save processing dollars with Protox oxides. It will pay you to take in a trial order now and count up all the advantages of Protox under your particular conditions.

*U. S. Patents 2, 303, 329 and 2, 303, 330

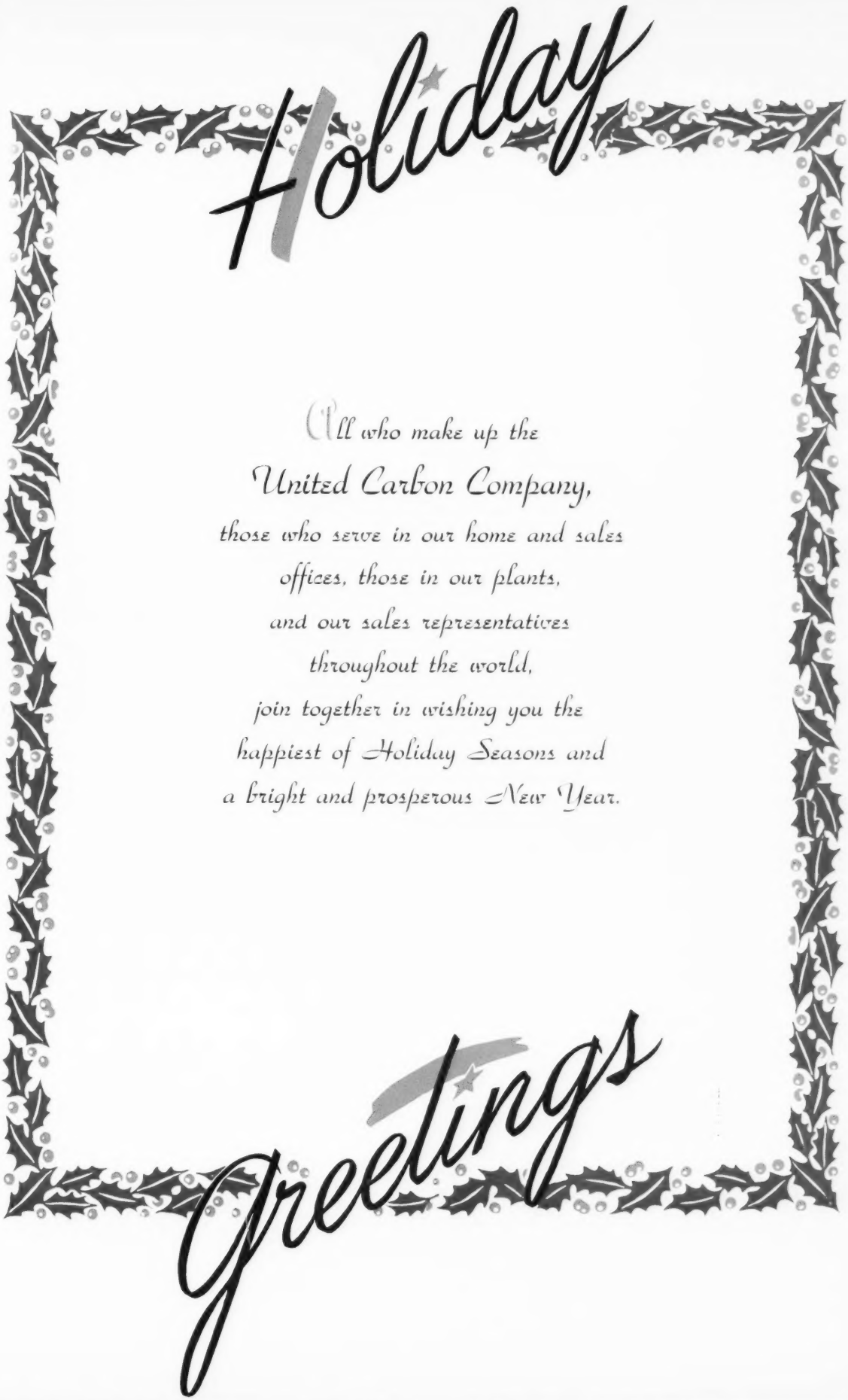
THE NEW JERSEY ZINC COMPANY

Producers of Horse Head Zinc Pigments

. . . most used by rubber manufacturers since 1852

160 Front Street, New York 38, N. Y.

HORSE HEAD PRODUCTS


Holiday
All who make up the
United Carbon Company,
those who serve in our home and sales
offices, those in our plants,
and our sales representatives
throughout the world,
join together in wishing you the
happiest of Holiday Seasons and
a bright and prosperous New Year.
Greetings

DIXIEDENSED S-66 (MPC) AND DIXIEDENSED 77 (EPC) are two blacks of great distinction. They are gas base, channel process blacks, free from processing difficulties and recognized as bulwarks of strength in any rubber. They build up less heat and have good flex life.

DIXIEDENSED S-66 AND DIXIEDENSED 77 are quality blacks of outstanding uniformity and dependability. Their balanced properties ease many compounding and service problems.

Standardize on United blacks for better results and product leadership.

UNITED CARBON COMPANY, INC.

CHARLESTON 27, WEST VIRGINIA

NEW YORK AKRON CHICAGO BOSTON MEMPHIS

In Athens... we make only one thing:

THE WORLD'S FINEST TIRE MOLDS

We don't know who said it first — but we believe it to the hilt — "practice makes perfect".

That's why we consolidated all our tire mold manufacturing facilities in our Athens plant — the only plant in the world, we believe, devoted exclusively to tire mold manufacture.

Here we utilize machines for one purpose only; build special controls, special jigs and fixtures for automatic operation without the problem of day to day changeover to meet other manufacturing requirements. Here craftsmen develop specialized skills to the highest degree. Here plant management is concerned with only one problem — how to make better tire molds.

What does it mean to the tire manufacturer? Two things: molds of unsurpassed quality; molds at the lowest possible cost.

1711

ATHENS MACHINE DIVISION

THE BRIDGWATER MACHINE COMPANY

Akron, Ohio

FOR BETTER MOLDS FOR BETTER TIRES *SPECIFY* BRIDGWATER

ZnO

is *definitely* in the picture

Of the many advantageous properties of rubber, perhaps the best known and most easily recognized is its resiliency. This property, for example, gives "bounce" and "zip" to golf balls. Zinc Oxide is an essential ingredient in nearly all products made from either natural or synthetic rubber compounds; it is one of the few basic ingredients which increases the wear and abrasion resistance of rubber *without materially decreasing its resiliency*. In the case of golf balls, where toughness is one of the chief requirements, this is an ideal combination of properties.

ST. JOE lead-free ZINC OXIDES are produced by a unique electrothermic method – a modification of the direct-from-ore, or American Process. Zinc Oxides thus produced combine most of the desirable properties of the American and French Process types. ST. JOE ZINC OXIDES are available in grades to fit most any need, and their uniform high quality accounts for their wide use by the country's leading producers of rubber products.

ST. JOSEPH LEAD COMPANY

250 PARK AVENUE, NEW YORK 17 *Plant & Laboratory, Monaca (Josephtown) Pa.*

DECLARED

NONtoxic

by F.D.A.*

Cabflex Di-BA

ODORLESS TASTELESS COLORLESS

DI-ISO-BUTYL ADIPATE

Cabflex® Di-OP
di-iso-octyl phthalate

Cabflex® DOP
di-2-ethylhexyl phthalate

Cabflex® ODP
iso-octyl decyl phthalate

Cabflex® DDP
di-decyl phthalate

Cabflex Di-OA®
di-iso-octyl adipate

Cabflex® DOA
di-2-ethylhexyl adipate

Cabflex® ODA
iso-octyl decyl adipate

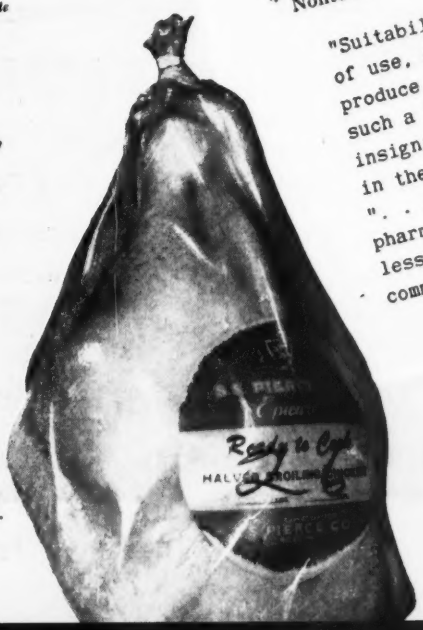
Cabflex® DDA
di-decyl adipate

Cabflex® Di-OZ
di-iso-octyl azelate

Cabflex Di-BA®
di-iso-butyl adipate

Cabol 100
hydrocarbon oil plasticizer

Cabot produces the nontoxic plasticizer Cabflex Di-BA and does not make the finished film.



* Nontoxic means "suitable" for use in food packaging materials.

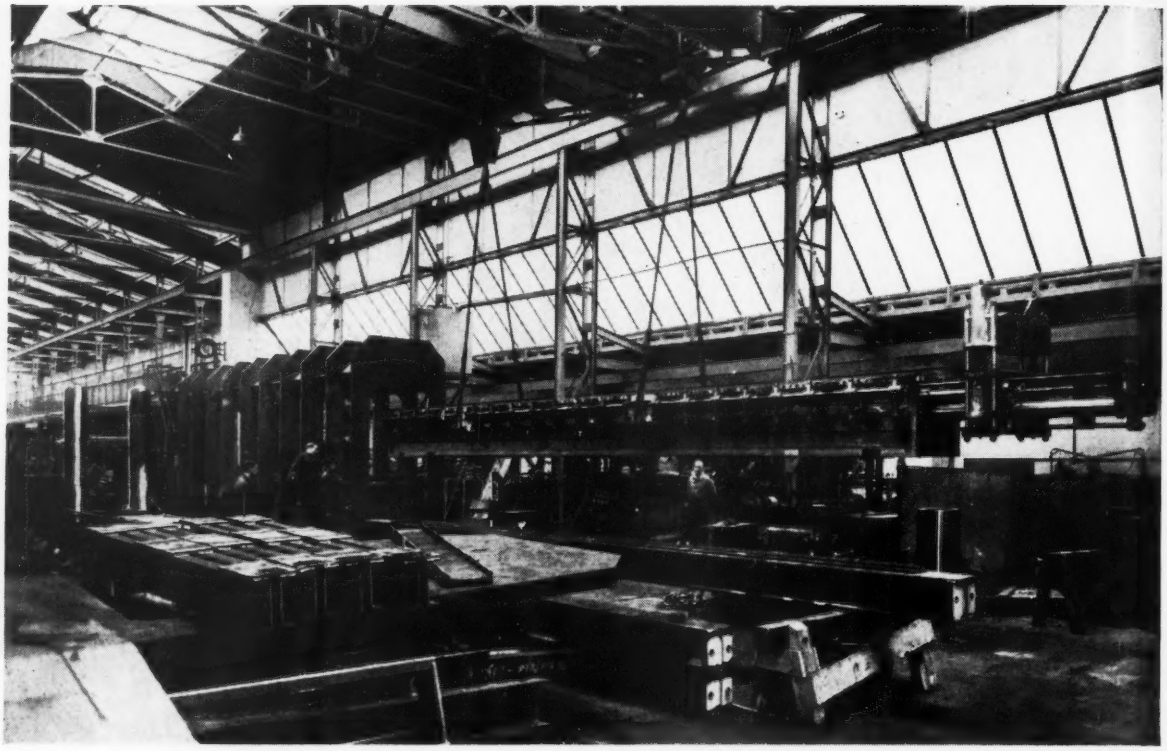
"Suitability means that under the conditions of use, and in the amounts now employed to produce a finished film, di-iso-butyl adipate has such a low order of solubility as to be insignificant as a food contaminant when weighed in the light of the toxicological evidence." ". . . this plasticizer has had adequate pharmacological study demonstrating its harmlessness in the amounts now used in finished commercial films . . ."

Reprinted from Association of Food & Drug Officials of the United States Vol. XV, No. 3, July 1951

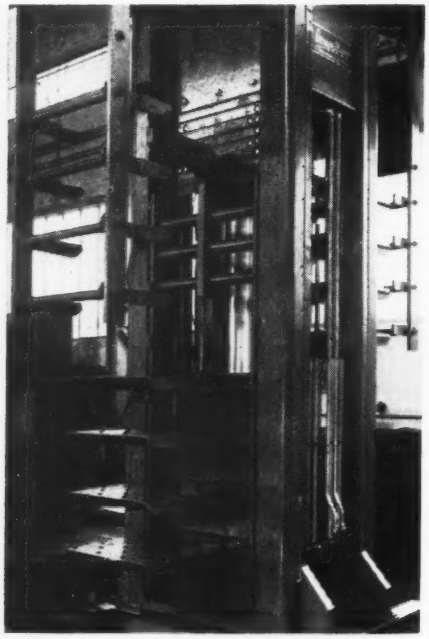
For product data sheets, further technical information and for samples, address

CABOT PLASTICS CHEMICALS DIVISION

GODFREY L. CABOT, INC.



Assembly of one of the larger presses for making conveyor belts and matting.



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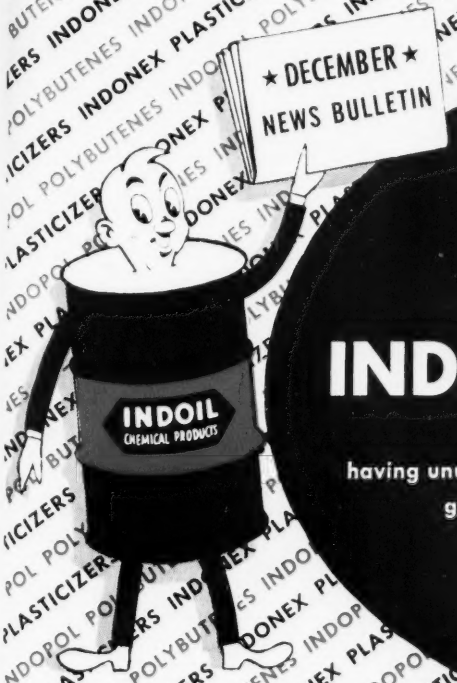

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having unusually low volatility and high oxidation resistance impart good shelf life, preserving building tack and reducing stiffening, and maintain good physical properties after curing.

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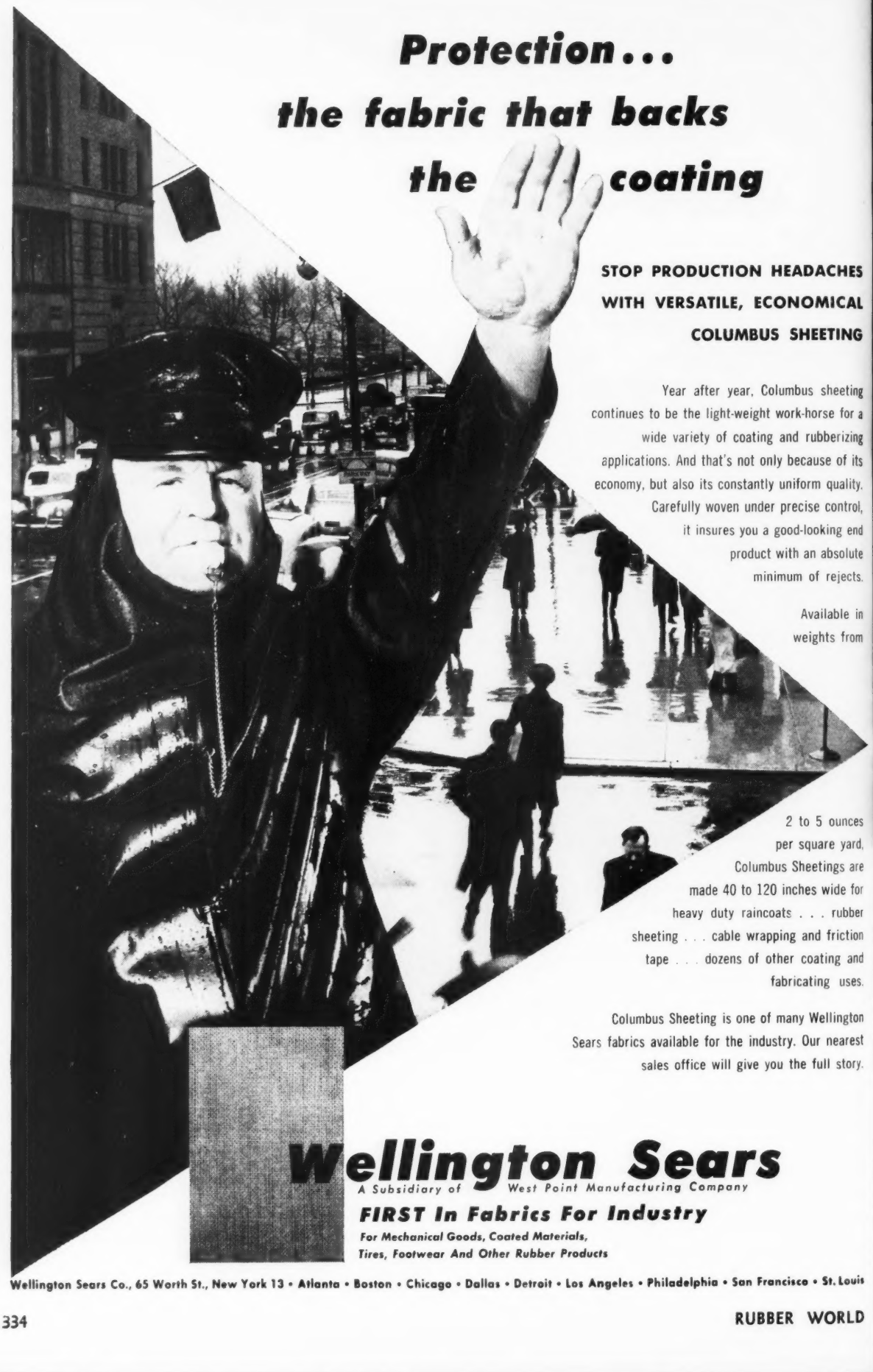

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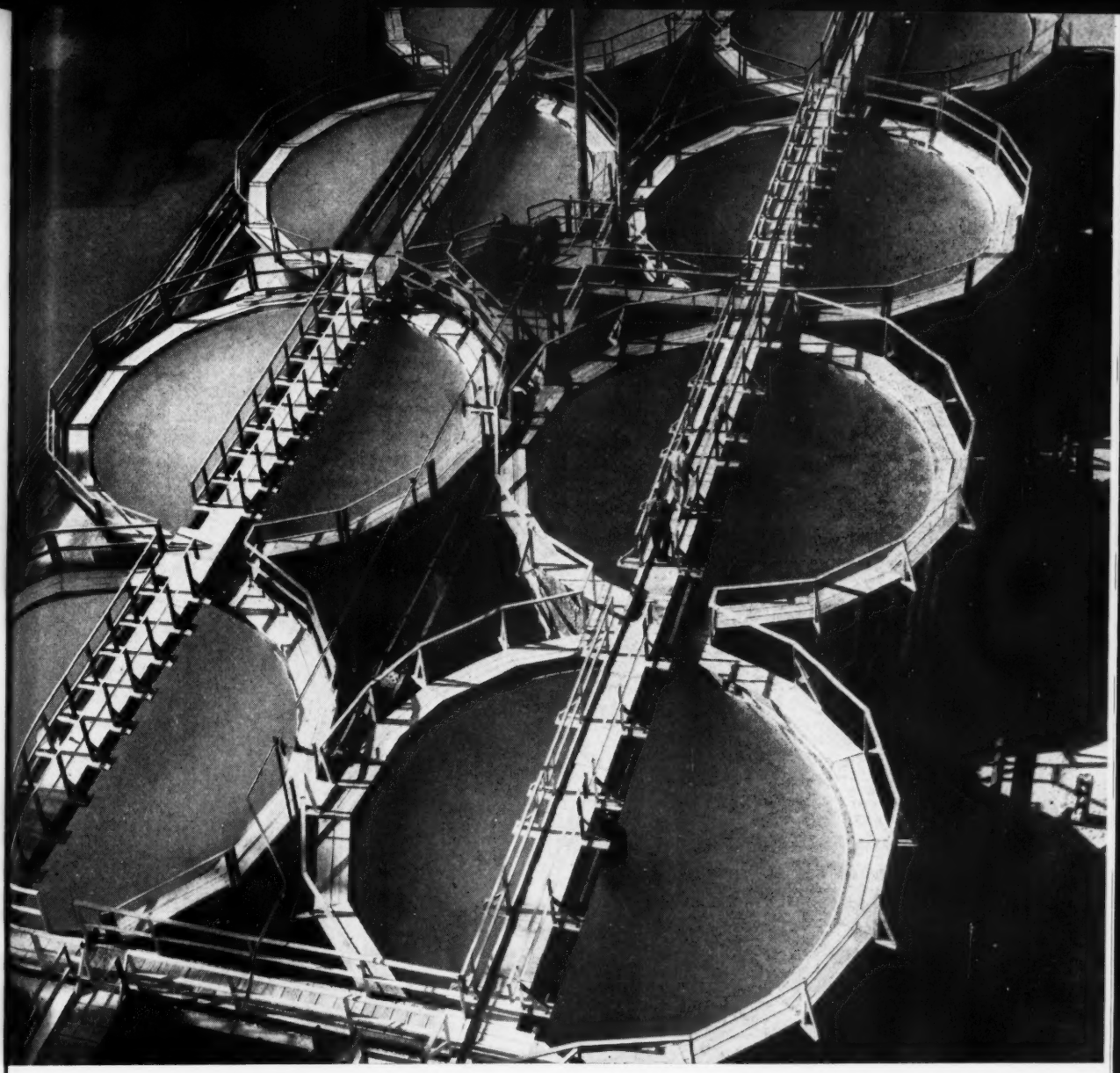

Mathieson Caustic Soda: *why settle for less?*

In the lime-soda process—one of the two important methods of making caustic soda—the causticizing operation begins in huge settling tanks like those above. Here, a soda ash solution is treated with milk of lime, calcium carbonate is precipitated and a dilute caustic liquor obtained. This liquid is then filtered and concentrated to the commercial 50% and 73% solutions, as well as to the solid, flake, and granular forms. Lime-soda process caustic is produced at Lake Charles, La., and Saltville, Va.; four other strategically located plants produce electrolytic process caustic to make Mathieson a major source of this essential chemical raw material.

Multiple-process and multiple-plant facilities give Mathieson's caustic soda customers the dependability they want. It means their source of caustic is not controlled by seasonal fluctuations in chlorine demand as is sometimes the case when production is limited to the electrolytic caustic-chlorine process. This operational flexibility is also typical of other Mathieson chemicals—5 chlorine plants, 7 sulphuric acid plants, 3 alkali plants, 3 ammonia plants, provide a safety factor that assures a reliable source of chemical raw materials.

Call on us when planning current or future chemical requirements. Perhaps you can buy to better advantage from one of America's largest producers of basic industrial chemicals.

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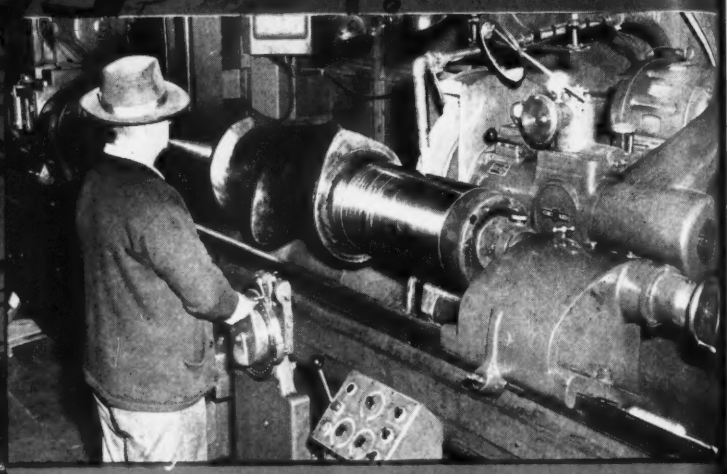
expert repair



we have
NEW IDEAS
which may interest you

● Banbury repairs require big facilities. Hale & Kullgren offer these facilities through association with The Aetna-Standard Engineering Company. This company installed more than $200,000 worth of special machine tools in their Warren, Ohio, plant for the specific purpose of repairing Banburys. These photos illustrate some of the actual Banbury repair work carried on in the big plant.

Repairing Banburys requires good craftsmanship, precision and accuracy. As specialists in metalworking for more than 50 years, Aetna-Standard has a superb reputation for expert work in the machinery business.

Hale & Kullgren adds the important know-how to Aetna-Standard's craftsmanship. H & K personnel have been associated with the rubber industry for as long as 30 years.

Much of the repair work requires building parts to the original. H & K have the patterns and can supply parts. In fact, most of them are carried in stock.

Call in Hale and Kullgren for fast, dependable Banbury repair service or rebuilding.

your inquiry...

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service on BANBURYS

OUR BIG SHOP HAS COMPLETE TOOLING FOR TOPNOTCH WORK

When you need Banbury repair parts or rebuilding service, remember . . . you have a service practically at your back door.

The big Aetna-Standard plant at Warren, Ohio, sparkles with $200,000 worth of tools specifically installed for Banbury repair and rebuilding work.

When Hale & Kullgren announced their entry into the rubber and plastic machinery business three years ago, many friends said in effect — "I hope you intend to repair and rebuild Banburys. We need a service close to us."

In those three years, the Warren Plant has been busy with Banbury orders. Many midwest companies prefer the "close-to-home" service, so they can control progress of the work. They also like the personal treatment. Their maintenance men can follow the work closely in the shops and keep check on the progress of the work.

Parts do not offer a problem. Aetna-Standard has the patterns and build parts to the originals.

Another service in conjunction with repairing . . . Hale and Kullgren's engineers have been busy redesigning some of the basic Banbury parts. Several new ideas have been developed which might interest you. These changes do not interfere with the interchangeability. For example, one idea gives better control of leakage in the mixing chamber. That problem has been a bugaboo for many years in the Banbury business.

For expert service on your Banburys, remember the midwest service offered by Hale & Kullgren, specialists in designing and building rubber and plastic machinery.

We have patterns and can supply any part . . . We stock most of them

A SWAP SERVICE

In many cases, for quick service, a swap of parts can be made. You receive a rebuilt body with all parts up to standard and guaranteed. This swap of parts cuts your down time to a minimum.

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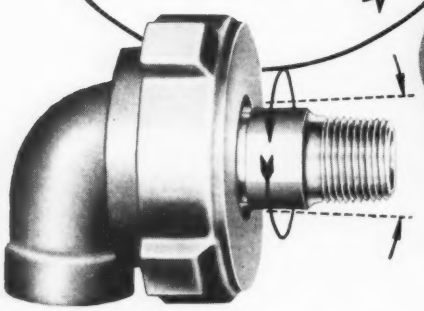

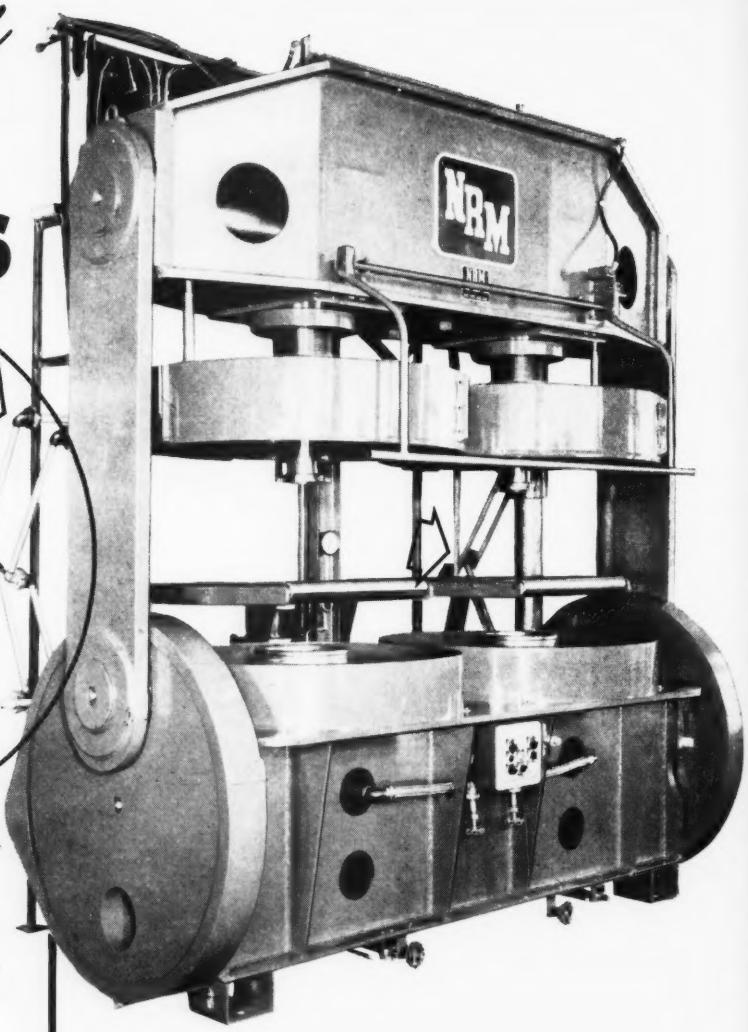

- **IMPROVED SEAL** — Barco's new No. 11CTS gasket is amazingly long wearing. Does not bake hard. Ideal for steam and water service. Does not cause excess wear on other parts.
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- **ENGINEERING RECOMMENDATIONS** — Send for a copy of Catalog No. 265A and installation drawing 10-52004.

SEND FOR CATALOG 265A

NATIONAL RUBBER MACHINERY COMPANY

of Akron, Ohio, and maker of the new NRM Packless Autoform Vulcanizer shown above, is one of the leading machinery builders who use Barco "Self-Aligning" Swivel Joints on dog leg piping connections to movable platens and molds. In a report on the performance of the equipment, the company writes, *"We have found Barco joints completely successful for this application."*

Use of improved Barco Swivel Joints make it easy to position the piping to (1) Insure Good Drainage, (2) Avoid Interference, and (3) Eliminate the Nuisance of Sagging, Flopping, Non-Rigid Lines. Because they are *self-aligning*, Barco Swivel Joints are easy to install. They cannot blow out unexpectedly. Internal construction automatically takes up for wear and keeps joints tight where there is alternating hot and cold service. No lubrication is required. Barco's new No. 11CTS gaskets greatly reduce torque and insure perfect sealing, regardless of temperature or pressure. Get this advanced performance NOW! Send for complete information on MODERNIZING old joints.

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The only truly complete line of flexible ball, swivel, swing and revolving joints

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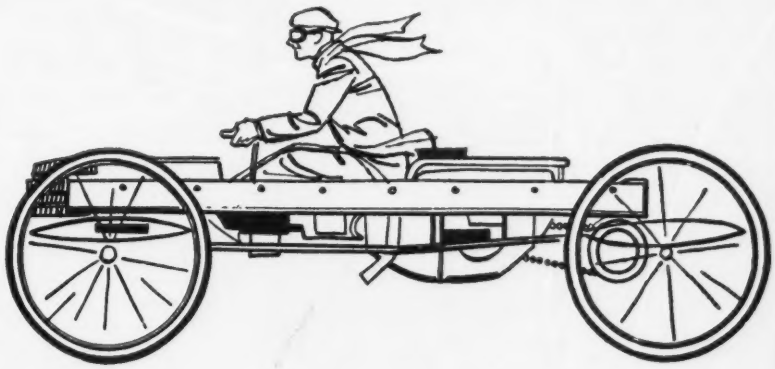
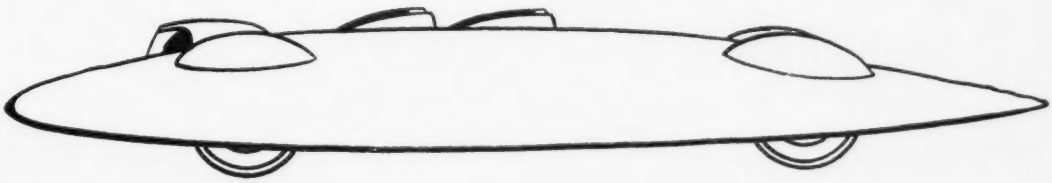
VORLD

How long did it take to get from here



to here?



Answer:
Forty-three years.

From the perky, wire-wheeled Stevens-Duryea Skeleton which whizzed around the track at Dayton, to the low-slung, torpedo-shaped Railton of John Cobb, there is an entire history of automobile development.

Partner in this development is Monsanto with its group of rubber chemicals, which have done—and are still doing—so much to improve tires and other rubber products.

One of these products is Monsanto's Insoluble Sulfur 60, which offers an economical and convenient way to use insoluble sulfur when such is indicated in the compound.

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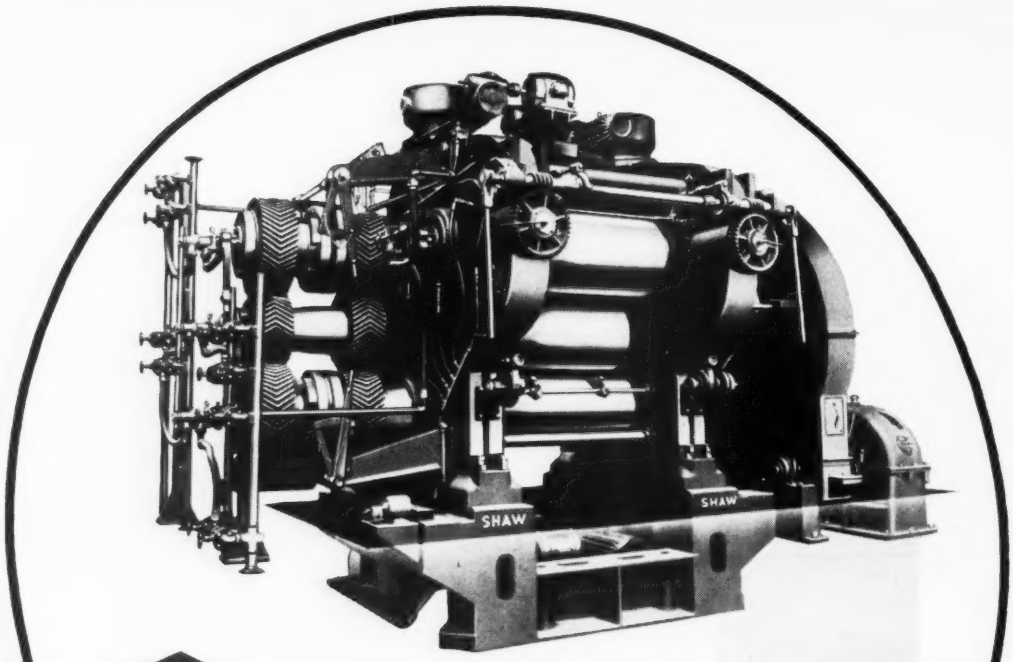

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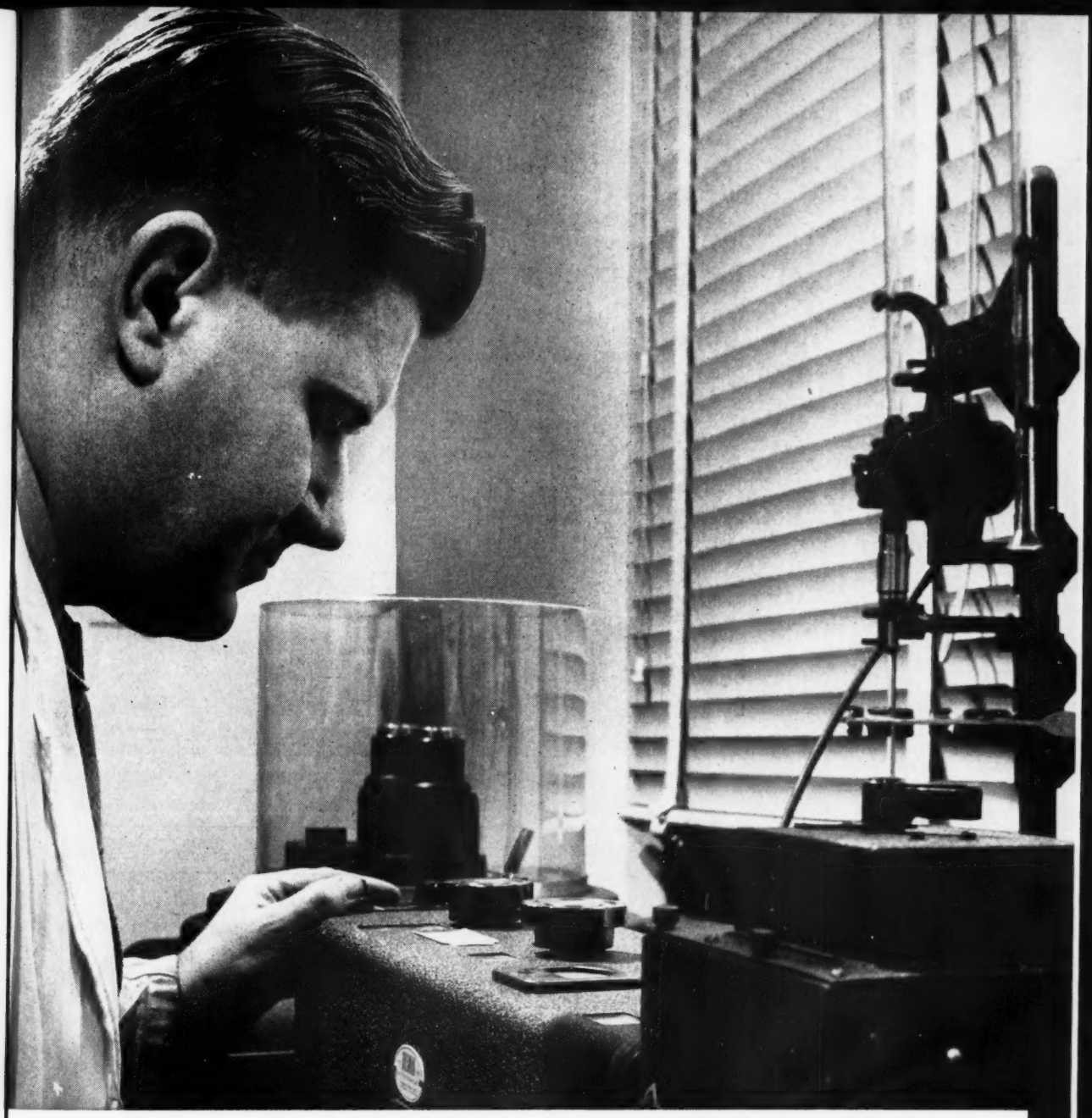

This color "fingerprinter" can't be fooled!

Production samples of Glidden chemical compounds must pass the rigid "fingerprint" test of the Spectrophotometer. Each compound has its own absorption spectra which must match the master sample. This method of testing is the most accurate known for color consistency and particle uniformity.

This exacting test is one of many in the Glidden Quality Control program that assures you of the finest pigment available, whether it be ZOPAQUE Titanium Dioxides; CADMOLITH Reds and Yellows; or SUNOLITH Lithopones. Write now for detailed information.

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CLOSER GAUGE CONTROL

with the F-B® "Tri-angular" calender

The right-angle roll arrangement of the Farrel-Birmingham Tri-angular calender assures closer control of gauge in any type of production requiring two passes. With only two rolls in any plane, there is no pressure from a third roll to affect roll settings and cause fluctuations in gauge. Hydraulic pullback cylinders hold the rolls in position, eliminating backlash in boxes and adjusting screws.

The angle of the rolls makes feeding easier. No feed table is necessary because the lower roll supports the feed bank. Both the bank and the guides are easily accessible from the floor level.

Where even closer control of gauge is desired a motorized crossed-axes device for regulation of roll crown is available. Other optional features include rolls drilled longitudinally for close temperature control, and the Farrel Uni-drive.

The Tri-angular calender is available in a choice of sizes. Write for further information.

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ANSONIA, CONN.
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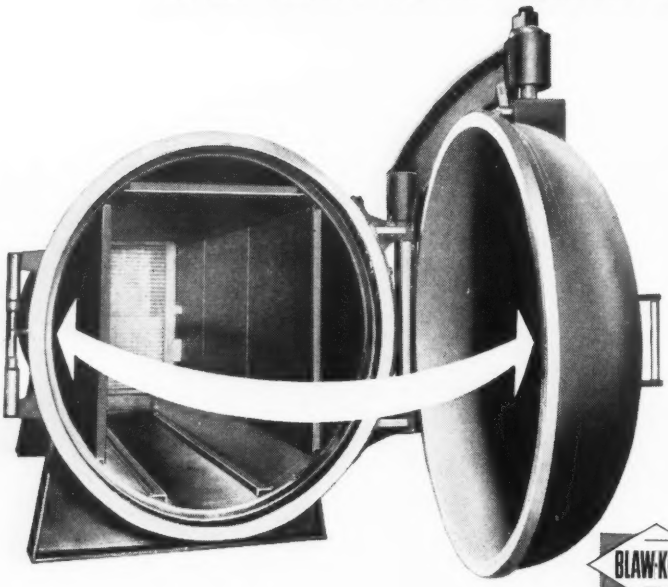
Farrel-Birmingham®

cut this cycle to seconds with Blaw-Knox Quick Opening Doors



Whether operated manually or mechanically, Blaw-Knox Quick Opening Doors are locked, unlocked, opened, or closed in a matter of seconds. They reduce the time spent on operations incidental to your process cycle.

A rim-locking mechanism fastens the doors securely into place without lugs, bolts, levers or bars. Easily replaced, self-sealing gaskets are operated by internal pressure.

If yours is a closure problem, specify Blaw-Knox Quick Opening Doors. They can be adapted to horizontal or vertical vessels.

Write for Quick Opening Door Bulletin 2435.

BLAW-KNOX COMPANY

Blaw-Knox Equipment Division
Process Equipment Department
Pittsburgh 38, Pennsylvania

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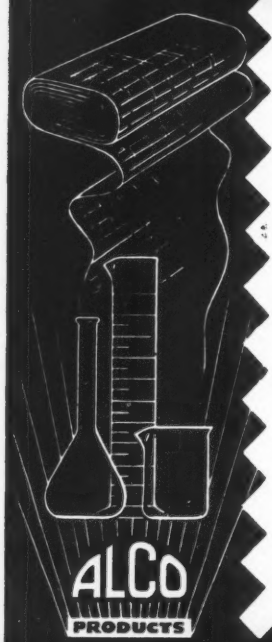

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The VULCANOLS REPRESENT a group of durable textile finishes which, when coated on textile fabrics, provide fiber conservation, pile anchorage, non-skid properties, slip resistance, and resistance to raveling or fraying.

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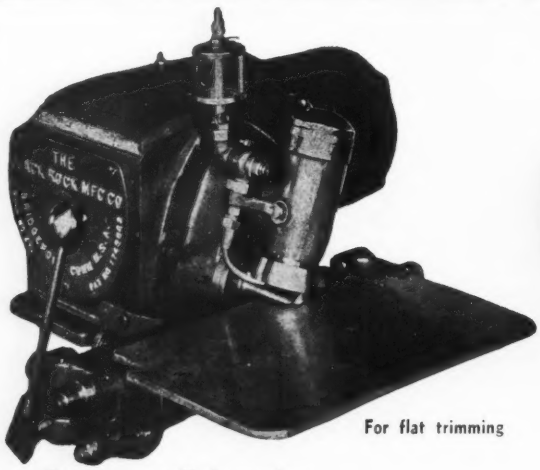

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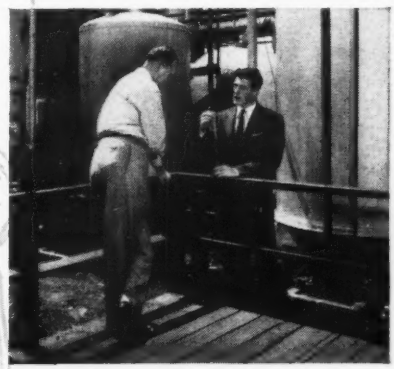

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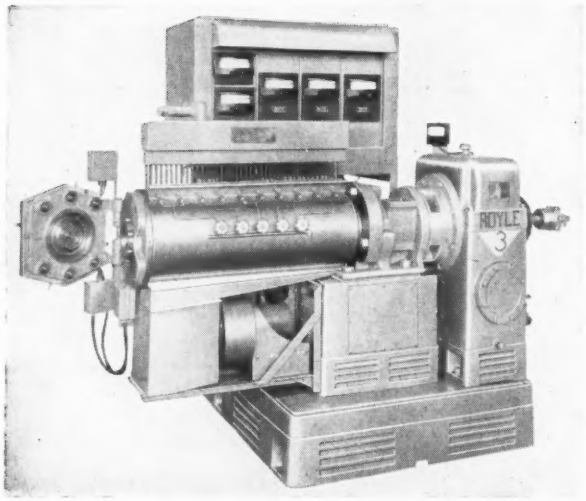

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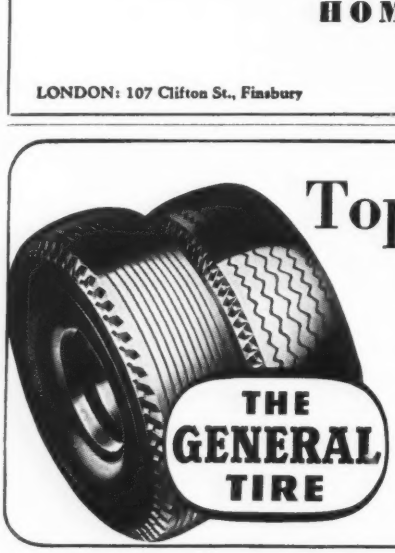

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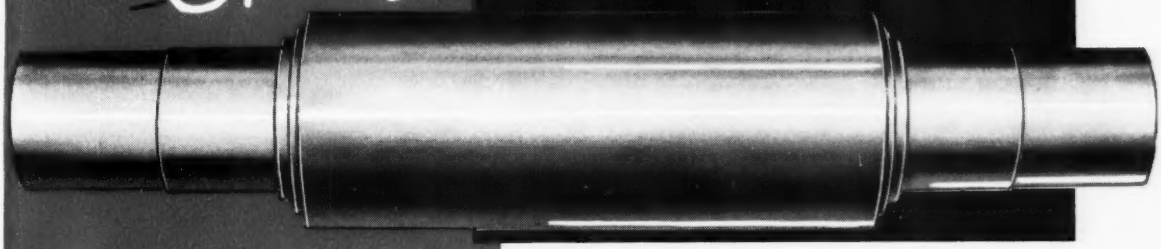

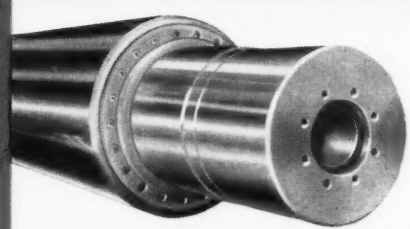

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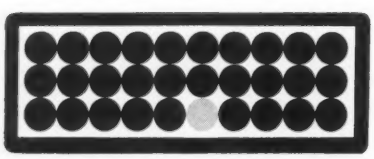

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Editorials

Rubber Industry Outlook for 1955

A PANEL discussion on the outlook for the rubber industry for 1955 was a part of the thirty-ninth annual meeting of The Rubber Manufacturers Association in New York on November 18. It provided a somewhat earlier-than-usual round-up of industry opinion on this important subject. Most of the details are presented in the National News section of this issue, but some special points of interest warrant further review and comment in this column.

W. J. Sears, vice president of the RMA, provided some real food for thought in part of his summary of the panel discussion when he said:

"This analysis of the outlook for 1955 demonstrates again that the rubber manufacturing industry is a growth industry. It is looking forward to new horizons. To meet this growth, an increase in capital investment will probably be necessary. Management in the rubber manufacturing industry must be progressive, must strive for profitable operations to attract the American investor, and thus meet the challenge of growing markets."

The Fabricating Branch

Growth in the fabricating branch of the industry is most directly related to automotive production and vehicle operation, and if the 1955-model cars sell as well as the automotive industry expects, original equipment tire sales should be as good or better than in 1954. Replacement tire sales should increase with the increased number of vehicles in operation two years or more of age and if the general level of business activity increases somewhat over that of 1954, as is estimated.

The tire branch of the industry has a big stake in 1955, however, in that in this year there will be the first really nationwide use of tubeless tires. In this connection, a very great increase in education of the public, particularly at the dealer and service-station level seems indicated. Prompt and satisfactory service for any trouble with these new tires may mean the difference between near-record and below-average sales.

Also tied to the automotive industry, but with extra added weight given to consumer durable goods, is the non-transportation rubber products sales, which are expected to maintain or better their position in 1955, if durable goods and automotive sales remain high.

The Synthetic Rubber Producing Branch

A big, new growth field for the rubber industry in 1955 is synthetic rubber production, sale, and distribution, if the government plants are turned over to private industry.

L. E. Spencer, assistant to the president, Goodyear Tire & Rubber Co., explained at the RMA meeting that private industry expects to shoulder its own responsibilities in connection with synthetic rubber in 1955.

Such a statement may be interpreted to mean that successful disposal next year is anticipated by the industry.

Assuming private industry operation, some further pertinent comments were made by Spencer. For example, larger inventories of GR-S, Butyl rubber, and of component materials will be maintained under private industry operation in order to insure that the several individual producers can successfully service their customers. Also, additional capacity for production will be built, and more in advance of actual needs than was the case under government operation, since private industry feels that it needs reserve capacity because of the uncertainties of the availability of natural rubber. Production costs may therefore be higher, but are considered well justified in order to make sure of uninterrupted supplies of synthetic rubber.

With the deliberate excess of production capacity contemplated, competition for customers will be keen, and these customers can be assured of adequate supplies and excellent service, Spencer concluded.

A whole new field of activity in the rubber industry may begin to develop in 1955, if and when private synthetic rubber production, sale, and distribution, on a major scale, become an established fact. More companies will devote more time to, and more companies will enter for the first time into, what has generally been considered the chemical industry. RUBBER WORLD is making plans to serve these new industry activities in an adequate manner.

R. G. Seaman

Graft Polymers Derived

By G. F. Bloomfield,[2] F. M. Merrett[2]

GRAFT polymers result when vinyl monomers are polymerized in the presence of natural rubber, either in solution or as latex, and some of the polymeric chains become attached to the rubber molecules. The properties of the natural rubber can be widely modified according to the nature and the amount of the grafted polymer. The polymer-modified natural rubber appears to be produced by direct growth of polymer chains on to rubber molecules rather than by a transfer reaction involving the rubber.

Graft polymers of styrene and methyl methacrylate with natural rubber can be compounded and cured to give light-colored articles of good tensile strength, and rubber-methyl methacrylate graft polymers have outstanding flex-cracking and fatigue resistance.

CONVENTIONAL methods for reinforcing natural rubber involve the addition of carbon black or inorganic fillers. More recent developments in reinforcement have utilized polymeric resinous materials such as lignin, cyclized rubber, phenolic resins, and vinyl polymers in finely divided form, and the degree of reinforcement obtained appears to be very dependent on the degree of dispersion and physical form of the dispersed particles as effected by mixing or coprecipitating rubber with the reinforcing agent.

An alternative technique involves the chemical grafting of vinyl polymer side-chains on to natural rubber. This should have a dual effect: first, the attached side-chains should be coiled and hence simulate the function of particulate fillers, and, being polymeric in character, might be expected to improve the fatigue properties without loss of elasticity; secondly, there is the possibility of control of the elastic properties of the product by variation in the polarity, flexibility, and chemical reactivity of the attached side-chains.

Among the earliest recorded attempts to modify rubber by polymerization of monomers dissolved in rubber or dispersed in latex were those sponsored by the Rubber Growers' Association and reported to the 1938 Rubber Technology Conference.[3] Later, Compagnon and Le Bras[4] described polymerization of acrylonitrile and other vinyl monomers in deammoniated rubber latex, with the aid of rather substantial amounts of ethyl hydroperoxide, benzoyl peroxide, or persulfates, and in some instances the solubility of the product was quite different from that of either the rubber or the polymer or mixtures of the two. Persulfate initiators appear to be less sensitive to ammonia than benzoyl peroxide, and some interesting modifications of rubber by polymers, and of polymers by rubber, have been described in the patent literature.[5] Working under very considerable difficulty during the Japanese occupation of Java, Koolhaas, van der Bie, and van Essen[6] succeeded in showing that some vinyl monomers (including acrylonitrile, methyl methacrylate, and styrene) could be polymerized after their addition to rubber latex, although ammonia was again observed to have a retarding action.

In none of the foregoing work has there been any clearcut evidence of combination of polymer with rubber, either by polymeric interaction or by graft polymerization. Nor have the modified rubbers been systematically evaluated.

In the present work the emphasis has been laid in the first place on establishing that combination does take place between rubber and the vinyl polymer and in determining the number and the length of the grafted chains. In addition, the aim has been to graft these side-chains on to the rubber by methods which could be controlled by known polymerization techniques.

Transfer Mechanisms in the Formation of Graft Polymers

Rubber contains labile α-methylenic hydrogen atoms which should be prone to capture by a growing vinyl polymer chain which would thus be converted into a polymer molecule while a free radical center would be created on the rubber molecule. From this center a new polymer chain should grow. Such transfer reactions have been studied extensively with vinyl monomers and ordinary transfer agents, such as isopropyl benzene, which contains an α-methylenic hydrogen atom, and carbon tetrachloride which has a labile halogen atom. It is well known that the molecular weight of the vinyl polymer due to early termination by the transfer agent obeys the relation

$$\frac{1}{P} = \frac{1}{P_o} + C\frac{(S)}{(M)} \qquad (1)$$

where P_o is the chain length in the absence of transfer agent, and P is the chain length when there is a molar ratio (S)/(M) of transfer agent to monomer. C is the transfer coefficient and expresses the frequency with which transfer occurs relative to the ordinary growth of the polymer chain. In the case of normal transfer agents the polymer chains initiated by catalyst or from the transfer agent are indistinguishable and inseparable, but when a macromolecular transfer agent is used, the chains initiated from the catalyst in the first step of the reaction will be free unattached vinyl polymer; whereas those initiated as a result of the transfer reaction will be attached to the rubber. The ratio R of bound polymer to free polymer is given by the relation

$$R = P_o.C.\ (S)/(M) \qquad (2)$$

The magnitude of C, the transfer coefficient, is a major factor in determining both P and R, and experiments were first made with a model polyisoprenic hydrocarbon dihydromyrcene[8] (DHM) in which the α-methylenic groups have a similar chemical reactivity to those in rubber. These experiments[7] gave the following values for C.

---

[1] Presented before the Third International Rubber Technology Conference, London, England, June 22, 1954.
[2] British Rubber Producers Research Association, Welwyn Garden City, Herts, England.
[3] R. G. R. Bacon, E. H. Farmer, P. Schidrowitz, *"Proceedings of the Rubber Technology Conferences,"* p. 525. W. Heffner & Sons, Ltd., Cambridge, England (1938).
[4] *Comptes rend.*, (1947) 212, 616; (1941) *Bull. soc. chim.*, 11, 553 (1944); *Rev. gen. caoutchouc*, 24, 281 (1947).
[5] British patent No. 573,062.
[6] *Arch. rubbercultuur*, 27 197 (1950).
[7] J. Scanlan, in press.

from Natural Rubber[1]

F. J. Popham[2] *and* P. McL. Swift[2]

Monomer	Transfer Coefficient
Styrene	2×10^{-4}
Methyl methacrylate	7×10^{-4}
Acrylate	4×10^{-3}
Vinyl acetate	4×10^{-2}

From equation (1) and (2) it can be seen that styrene should give a small number of long chains, the ratio of attached to free polymer being small; whereas with vinyl acetate there should be a large number of small chains grafted to the rubber with only a small amount of unattached vinyl polymer. Examination of these differences has been impeded by the fact that both DHM and rubber severely retard the polymerization of vinyl acetate. For this reason, and also because it was believed that longer side-chains would give a more readily detectable pattern of combination with rubber, the methyl methacrylate and styrene systems have been studied more.

Graft Polymers Based on Methyl Methacrylate and Styrene

When the interaction of rubber and methyl methacrylate was studied in solution, it was found that, using benzoyl peroxide as catalyst, combination did take place, but that the attached polymer chains were very much shorter and more numerous than the unattached chains.[8] The proof of this condition depended on a rigid separation of the three possible components of the reaction, viz., rubber, rubber-vinyl polymer *compound*, and free vinyl polymer.

The separation was made by adding methyl alcohol to a 1% solution in benzene of the "gross" polymer. All the *free* rubber precipitated after 25% of alcohol (on volume of original solution) had been added. Subsequent addition of alcohol caused the formation of a very stable sol, the particles of which apparently consisted of a collapsed rubber chain kept in Brownian movement by the continued solubility of the vinyl polymer side-chains. The extraordinary stability of this sol, which does not coagulate on boiling or on treatment with large concentrations of ionic substances such as calcium chloride, testified to the marked degree to which the rubber had been modified. When about 180% of methyl alcohol had been added, the sol flocculated (aided by the presence of a minute trace of calcium chloride), presumably owing to collapse of the side-chains. After a certain further addition of methyl alcohol the free vinyl polymer started to separate; there was always a reasonable gap between flocculation of the sol and the precipitation of the free vinyl polymer. Critical checks of this separative procedure showed that effective separation had taken place and confirmed that the middle fraction was undoubtedly the rubber-polymer compound alone. A suitable modification to the solvent mixture enabled the method to be applied to styrene-modified rubber.

The relative amounts and molecular weights of the three fractions present showed that while the free vinyl polymers reached their expected molecular weight in the range 200,000 to 500,000, the attached chains had a molecular weight as low as 2,000, that is, about 20 monomer units. This statement was true of both methyl methacrylate and styrene, despite their different transfer coefficients. The amount of bound vinyl polymer, despite the shortness of the chains, was somewhat greater than that calculated from the transfer theory.

Influence of Initiator on Course of Polymerization

The efficiency of benzoyl peroxide is known to vary with environment owing to complicated side reactions; therefore the above experiments were repeated, using azo*iso*butyronitrile (AZBN), whose decomposition is known to be insensitive to environment. The results showed that very little vinyl polymer was attached to the rubber; 95% or more of the monomer polymerized gave free polymethyl methacrylate or polystyrene of the usual high molecular weight.

This difference in behavior of systems initiated with peroxides and AZBN can be demonstrated visually. If methyl methacrylate containing 10 to 20% of dissolved rubber is polymerized in bulk with benzoyl peroxide, a tough translucent polymer is obtained. With AZBN the product is an opaque brittle mass, demonstrating the poor mutual solubility of rubber and free vinyl polymer.

Thus neither the results with benzoyl peroxide nor with AZBN as catalyst correspond with those predicted by the transfer theory. It is not possible to say whether the large number of attached chains produced is due to direct attack on the rubber by peroxidic catalysts or to a higher transfer rate once the first transfer act with the rubber has occurred. The former is unlikely because of the very great increase in the number of required initiating points, and the latter is complicated because the experimental results show quite clearly that the graft side-chains are spread evenly among all the rubber molecules. The failure of AZBN to produce graft polymer, while allowing polymerization of the monomer to proceed to high yields independently of the rubber, would appear to eliminate transfer as the operative step in the formation of graft polymers.

Graft Polymers from Rubber Latex

Although the foregoing quantitative interpretation of the reaction of styrene and methyl methacrylate with rubber has been derived from experiments conducted in solution, the same state of affairs has been shown to exist in polymerizations conducted in rubber latex, irrespective of whether benzoyl peroxide or an activated hydroperoxide redox system was used. Persulfate initiation of methyl methacrylate gave substantially less graft polymer and correspondingly more free polymer.

On a technical scale, the preferred initiator for the preparation of graft polymers based on either styrene or methyl methacrylate was a polyamine-activated hydroperoxide,[9] since this gave high yields without the necessity of deammoniating or deareating the latex.

Technology of Graft Polymers

Hard vinyl polymers, such as styrene and methyl

[8] F. M. Merrett, in press.
[9] G. F. Bloomfield, *Rubber Developments*, 5, 34 (1952).

methacrylate, substantially reinforce rubber, whether present in simple admixture with rubber (designated "mixed polymers") or as graft polymers in admixture with the concomitantly formed free polymer (the total composition is treated as graft polymer and is accordingly so designated in this paper). The graft polymers can be readily compounded and cured in conventional recipes to give light-colored articles of high tensile strength and, in the case of rubber-methyl methacrylate, they show reduced hysteresis and outstanding resistance to flex cracking and fatigue. Stiffening at low elongations is greater with mixed polymers than with graft polymers, but is similar at higher elongations (more than 300%); a given level of reinforcement in styrene graft polymers requires about 50% more monomer than is the case with methyl methacrylate. Fuller details of the technical properties of these graft polymers will appear elsewhere;[10] softer vinyl polymers, as exemplified by the higher methacrylates, give less reinforcement as the size of the ester group is increased (Table 1).

TABLE 1. TENSILE PROPERTIES OF RUBBER-METHACRYLATE GRAFT POLYMERS

(30 Parts Methacrylate per 100 Rubber)

Compounding: Polymer	100
Zinc oxide	5.1
Sulfur	2.5
Stearic acid	1.0
Santocure	0.6
PBN	1.0

Cure: 20 min. at 140° C.

Methacrylate	Tensile Strength Kgm./Cm.²	(Psi.)	Eb. %	M_{100} Kgm./Cm.²	(Psi.)	M_{300} Kgm./Cm.²	(Psi.)	Shore Hardness
Methyl	280	(3982)	560	32	(455)	120	(1706)	75
Ethyl	240	(3413)	553	24	(341)	86	(1223)	63
Iso-butyl	225	(3200)	578	17	(242)	61	(867)	55
n-Butyl	190	(2702)	613	14	(199)	38	(540)	56
β-Ethoxy-ethyl	198	(2816)	735	9	(128)	18	(256)	53

Acrylates behave similarly to methacrylates in giving good yields of graft polymers in the presence of rubber, but the products are substantially different in that snappy, insoluble materials are obtained if the polymerization is allowed to run to high monomer-conversion. These products undergo finite swelling in solvents and thus appear to be quite heavily cross-linked, although the cross-linkages are of an unusual type in that the material can be readily sheeted into a smooth velvety sheet on a cold mill. Although an infrared examination of cast films showed the unsaturation to be mainly intact, the acrylate graft polymers appear more resistant than raw rubber to thermal oxidation, and no useful vulcanizates can be obtained with either accelerated sulfur, peroxides, tetramethyl thiuram disulfide, alkalies, or quinone dioxime recipes. Higher acrylic esters give similar materials. Consequently no technical information is available on acrylate graft polymers.

TABLE 2. TENSILE PROPERTIES OF ETHYL ACRYLATE-METHYL METHACRYLATE GRAFT COPOLYMERS

(Compounding and Cure as Table 1)

Monomers Polymerized per 100 Rubber MM	EA	Tensile Strength Kgm./Cm.²	(Psi.)	Eb. %	M_{100} Kgm./Cm.²	(Psi.)	M_{300} Kgm./Cm.²	(Psi.)	Shore Hardness
32	0	270	(3839)	550	38	(540)	128	(1820)	80
30	2	200	(2844)	420	36	(512)	125	(1778)	80
28	4	233	(3313)	483	26	(370)	112	(1593)	73
26	6	204	(2901)	448	30	(427)	111	(1578)	75
24	8	212	(3015)	455	25	(356)	111	(1578)	73

Progressive replacement of methyl methacrylate by ethyl acrylate in rubber-methyl methacrylate graft polymers reduces the modulus of the rubber-methyl methacrylate vulcanizate without apparently introducing any advantageous feature (Table 2).

Cross-Linking Agents in Graft Polymers

When a divinyl monomer is added to the styrene or methyl methacrylate used in the above systems, the graft polymer is modified by the cross-linking introduced between the polymeric side-chains and the free polymer, but quite substantial proportions of divinyl monomer can be added before the polymers become unprocessable. The modified polymers are generally harder, but the principal effect of the divinyl monomer is an enhanced tear resistance which is otherwise poor in unmodified rubber-styrene or rubber-methyl methacrylate graft polymers.

Polymerization of Other Monomers in Presence of Rubber

The polymerization of vinyl acetate is so severely retarded by rubber and polyisoprenes[7, 11] that it would be predicted that graft polymers derived from vinyl acetate cannot be prepared. Only the presence of high proportions of emulsifying stabilizers has led to any success in polymerizing vinyl acetate in rubber latex, and under these conditions the monomer polymerized independently of the rubber to give a mixed product indistinguishable from that obtained by mixing rubber latex and a polyvinyl acetate emulsion. Possibly for similar reasons, vinyl chloride has not been successfully polymerized in the presence of rubber.

TABLE 3. PROPERTIES OF ACRYLONITRILE-MODIFIED RUBBER AT OPTIMUM CURE

Vulcanizing Ingredients per 100 Parts of Rubber in Polymer						
Zinc oxide	5.0					
Sulfur	3.0					
Stearic acid	1.0					
Santocure	0.7					
PBN	1.0					
Parts acrylonitrile per 100 rubber:	26		19		11.5	
Cure, min. at 140° C.	30		40		40	
Tensile strength, kgm. cm.² (psi.)	82	(1166)	98	(1394)	69	(981)
Elongation at break, %	223		295		210	
M_{100}, kgm./cm.² (psi.)	51	(725)	32	(455)	34	(483)
M_{300}, kgm./cm.² (psi.)	75	(1067)	62	(882)	67	(953)
B. S. I. hardness	86		76		64	
% Increase in length in:						
Benzene	36		44		48	
Standard fuel	24		36		38	
Oil	12		22		24	

The authors express their thanks to C. R. Porter and R. I. Wood for the above data.

Although activated persulfate initiating systems are quite efficient in bringing about the polymerization of vinylidene chloride and acrylonitrile in aqueous systems, they were singularly ineffective in promoting polymerizations of these monomers in rubber latex. The very active redox system comprising hydroperoxide/ferrous iron/dihydroxyacetone[12] proved much more effective, and high conversions of both monomers were obtained at 40° C. in rubber latex stabilized with Lubrol W or Perlancrol C. No practical application has been found for the rubber-vinylidene chloride product owing to its

(Continued on page 418)

[10] "Heveaplus M." B.R.P.R.A. Technical Bulletin, No. 1. The British Rubber Development Board, Market Buildings, Mark Lane, London, E.C. 3, England.
[11] P. W. Allen and F. M. Merrett, unpublished results.
[12] I. M. Kolthoff and A. I. Medalia, *J. Polymer Sci.*, 6, 189 (1951).

Properties of Tri-Octyl Phosphate Latex Masterbatched Butadiene/Styrene Polymers[1]

By R. F. McCann[2]

TRI-OCTYL phosphate latex masterbatched butadiene/styrene polymers of varying monomer ratios exhibit improved processing, extruding, tensile strength, and elongation values with increasing styrene content.

Low-temperature properties generally improved with decreasing styrene content. Low-temperature compression set values were quite high for 50/50 Bd/S polymers, but were lower than those for the same polymer without the plasticizer.

PREVIOUS work (1-7)[3] has indicated that the low-temperature flexibility of polymers can be improved by incorporating plasticizers by mill mixing or latex masterbatching. The advent of oil-masterbatching techniques on a large scale suggested the incorporation of a low-temperature plasticizer with latices of high-viscosity polymers to yield polymers with improved low-temperature properties while maintaining satisfactory processing and stress-strain properties (8-10).

Tri-octyl phosphate[4]

$$[C_4H_9CH(C_2H_5)CH_2O-]_3P{=}O, \quad \text{mol. wt.}{=}434.6$$

is a non-volatile liquid with practically no odor and is a recognized low-temperature ester-type plasticizer for synthetic polymers. Elastomers containing tri-octyl phosphate are considerably less sensitive to moderate temperature changes, and this attribute prompted its use in applications where other plasticized compounds are unsuitable because they become too rigid at low temperatures. Consequently tri-octyl phosphate was evaluated at a 25-part loading in latices made at 122 and 41° F. with 100/0, 95/5, 85/15, 75/25, and 50/50 butadiene/styrene charges. Polymers prepared by the latex masterbatching technique are discussed with respect to stress-strain properties, hysteresis, low-temperature flexibility as determined by the Gehman method, compression set, and temperature of retraction.

Preparation of the Latices for Masterbatching

The base latices employing monomer ratios of 100/0, 95/5, 90/10, 85/15, 75/25, and 50/50 butadiene/styrene were prepared at 122° F. to approximately 60% conversion in accordance with the persulfate initiated formula. In addition, latices were prepared at 41° F. to about 60% conversion, employing the sugar-free iron-pyrophosphate formula and monomer charges of 90/10, 85/15, 75/25, and 50/50 butadiene/styrene. All of the latices were made with rosin soap emulsification, and the viscosities of the contained polymers varied from 106 to 122 ML-4 prior to masterbatching with 25 parts of tri-octyl phosphate. Chemical properties of the masterbatched polymers are presented in Table 1.

[1] The work discussed herein was performed as a part of the research project sponsored by the Federal Facilities Corp., Office of Synthetic Rubber, Washington, D. C., in connection with the Government Synthetic Rubber Program.

[2] Government Laboratories, University of Akron, Akron, O.

[3] Numbers in parentheses refer to Bibliography items at end of this article.

[4] Carbide & Carbon Chemicals Co., division of Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N.Y.

TABLE 1. CHEMICAL PROPERTIES OF THE TRI-OCTYL PHOSPHATE MASTERBATCHES

Monomer Ratio BD/S	Ash %	Rosin Soap %	Rosin Acid %	Acetone Extract %	Gel %	DSV	Combined Styrene* %	Gel* %	DSV*	Acetone Extract %*†
Polymers Prepared at 122° F.										
100/0	3.20	0.06	5.47	28.13	34	1.20	—	50	1.32	8.90
95/5	2.59	0.06	5.67	27.12	36	1.33	4.8	33	2.34	8.54
90/10	3.45	0.11	5.27	27.01	37	1.16	7.9	44	1.79	8.41
85/15	3.35	0.15	5.37	29.99	30	1.46	11.7	36	1.81	8.50
75/25	2.73	0.16	5.32	27.59	34	1.27	19.9	32-51	2.15-2.54	8.94
50/50	4.54	0.18	5.31	26.69	29	1.83	40.8	58	3.15	8.41
71/29‡	—	—	—	—	—	—	24.1	2	2.24	8.03
Polymers Prepared at 41° F.										
90/10	3.42	0.62	5.13	26.55	6	2.57	7.2	6	3.01	7.22
85/15	3.98	0.29	5.54	29.90	2	2.32	11.7	1	3.08	7.31
75/25	2.18	0.13	5.45	26.84	2	2.34	21.1	2	2.88	8.29
50/50	2.43	0.23	5.43	26.57	2	2.04	43.7	2	2.58	7.77
75/25§	—	—	—	—	—	—	21.2	1	1.80	8.72

*Determined on a sample of the base polymer prior to masterbatching with tri-octyl phosphate.
†Determined by extracting the samples for 15 hours in a Soxhlet unit.
‡GR-S-1002 control.
§X-624 control.

TABLE 2. PROCESSING AND STRESS-STRAIN PROPERTIES OF THE TRI-OCTYL PHOSPHATE MASTERBATCHES

Monomer Ratio BD/S	Base Polymer Viscosity ML-4	Vis-cosity ML-4	Mill Compd. Viscosity ML-4	Mill Shrink-age %	Mill Rough-ness	Mill Pro-cessing Index	Extru-sion Index	Stress-Strain Properties at 77° F. Polymers Cured at 292° F. 200% Modulus Psi., Min. 25	50	100	Tensile Strength Psi.*	Maximum Tensile Strength Psi.	Elonga-tion %*
Polymers Prepared at 122° F.													
100/0	106	55	95	43	31	15.1	11	1130	1070	1130	1480	1480	230
95/5	110	56	71	46	1	14.4	13.5	1100	1180	1160	1740	1840	250
90/10	111	57	71	42	10	13.1	13.5	1050	1200	1120	1760	1870	260
85/15	110	49	62	47	5	11.6	14.5	1090	1150	1090	1960	2010	280
75/25	120	55	58	41	8	7.6	16	1010	1210	1200	2370	2370	310
50/50	109	53	52	22	8	3.4	16	†2170	†2570	†2640	2970	2970	340
71/29‡	—	54	55	52	18	7.4	10	†650	†1220	†1630	3140	3280	570
Polymers Prepared at 41° F.													
90/10	122	64	72	56	17	7.1	14.5	†2090	†2250	†2180	2520	2770	330
85/15	116	51	54	39	7	3.7	15.5	†2280	†2390	†2300	2600	2700	320
75/25	109	51	57	37	8	3.8	16	†2240	†2540	†2670	2650	2980	310
50/50	108	38	51	22	8	3.4	16	†2240	†2640	†2860	2790	2920	310
75/25§	—	52	63	54	17	5.6	9	†430	†970	†1530	4210	4210	730

*Values obtained at the 50-minute cure.
†300% Modulus.
‡GR-S-1002 control.
§X-624 control.

TABLE 3. HYSTERESIS, REBOUND, AND GEHMAN PROPERTIES OF THE TRI-OCTYL PHOSPHATE MASTERBATCHES

Monomer Ratio BD/S	Hysteresis Temp. Rise, °F. Min. 25	50	Set, % Min. 25	50	Flex-Life x10⁻³ Min. 25	50	Quality Index Min. 25	50	Rebound at 50-Min. Cure 77° F.	212° F.	Gehman Values, −° C., at 50-Min. Cure T_2	T_5	T_{10}	T_{100}	F. P.
Polymers Prepared at 122° F.															
100/0	36	41	7.4	6.4	1	1	0.8	0.7	60	72	60	71	74	79	80
95/5	43	41	11.8	6.6	0.1	0.2	<0.1	<0.1	62	74	54	66	69	75	76
90/10	42	45	6.9	5.2	0.6	0.5	0.4	0.3	59	72	52	64	66	72	71
85/15	39	40	9.8	6.5	1	1	0.7	0.6	61	74	51	63	66	73	73
75/25	44	42	9.4	5.9	7	2	4.1	1.3	52	74	45	56	57	61	61
50/50	40	38	11.6	6.2	1	1	0.7	0.7	56	76	24	31	34	42	43
71/29*	58	41	22.4	9.5	4	4	1.5	2.6	56	69	26	40	42	49	49
Polymers Prepared at 41° F.															
90/10	43	45	9.3	6.2	2	1	1.3	0.6	63	75	57	65	68	73	72
85/15	35	36	7.2	4.5	1	1	0.8	0.8	64	78	55	64	66	72	72
75/25	38	38	8.0	5.1	1	1	0.7	0.7	62	76	46	53	56	63	64
50/50	40	39	11.0	6.5	14	8	9.5	5.6	55	76	21	28	31	39	38
75/25†	46	43	8.7	5.6	8	7	4.4	4.3	62	75	32	40	43	49	48

*GR-S-1002 control.
†X-624 control.

Latex-Emulsion Preparation

The tri-octyl phosphate was emulsified with 2.0 parts of potassium oleate and 97 parts of water (based on the plasticizer) and then added to the latices. The masterbatches were coagulated by adding mixtures of the emulsified plasticizer and latex to 20 parts of sodium chloride as a 10% brine solution, followed by the addition of 1% sulfuric acid solution until a serum pH of 2.0 to 3.0 resulted. To insure adequate conversion of the soap to acid, the polymer crumb was kept in the serum for 90 minutes. The masterbatched polymers were then dried at 140° F. in a forced-draft oven and tested.

Processing and Stress-Strain Tests

122° F. Masterbatched Polymer

With increasing styrene content the mill processing properties of the masterbatches improved, ranging from 15.1 for the polybutadiene to 3.4 for 50/50 butadiene/styrene copolymer. Similarly, the extrusion properties improved, as evidenced by Garvey die extrusion values of 11 for the polybutadiene and 16 for the 50/50 BD/S copolymer. As would be expected, the tensile strength and elongation values increased with increasing styrene content (from 1480 to 2970 psi. and from 230 to 340%). GR-S-1002, a 71/29 butadiene/styrene production copolymer prepared at 117° F., is included in Table 2 for comparison.

41° F. Masterbatched Polymers

For the copolymers prepared at 41° F. the mill processing improved with increasing styrene content, ranging from 7.1 for 90/10 BD/S to 3.4 for 50/50 BD/S; the extrudibility was about the same for all ratios (14.5 to 16), and a slight increase in tensile strength was generally observed for polymers containing the larger amounts of styrene (from 2700 to 2920 psi.). X-624, a 75/25 butadiene/styrene standard GR-S, 41° F. copolymer is included for comparison.

Hysteresis, Rebound, Gehman Low-Temperature Values

The hysteresis temperature rise values for the polymers prepared at either 122 or 41° F. were similar, ranging from 36 to 45° F. with no particular trend attributable to the styrene content, as were the Goodyear rebound values ranging from 72 to 78% when the vulcanizates were tested at 212° F. (Table 3).

The Gehman low-temperature properties of the masterbatches improved with decreasing styrene content, exhibiting freeze points of —80 to —43° C. for the 122° F. polymer (Table 3 and Figure 1) and —72 to —38° C. for the polymer prepared at 41° F. (Table 3 and Figure 2). The greatest beneficial effect from the tri-octyl phosphate was observed with the 50/50 BD/S charge levels; the freeze point was decreased from the normal —18° C. for base polymer of this type to —38 to —43° C. by the

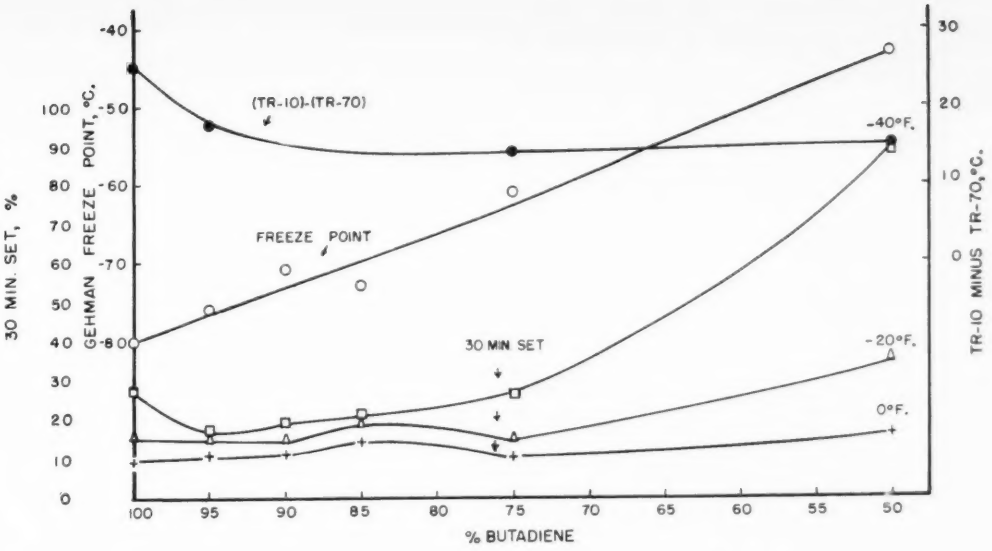

Fig. 1. (TR-10)-(TR-70) Values, 30-Minute Compression Set and Gehman Freeze Point Data for Stocks Prepared at 122° F. with Varying Amounts of Styrene and Masterbatched with 25 parts of Tri-Octyl Phosphate

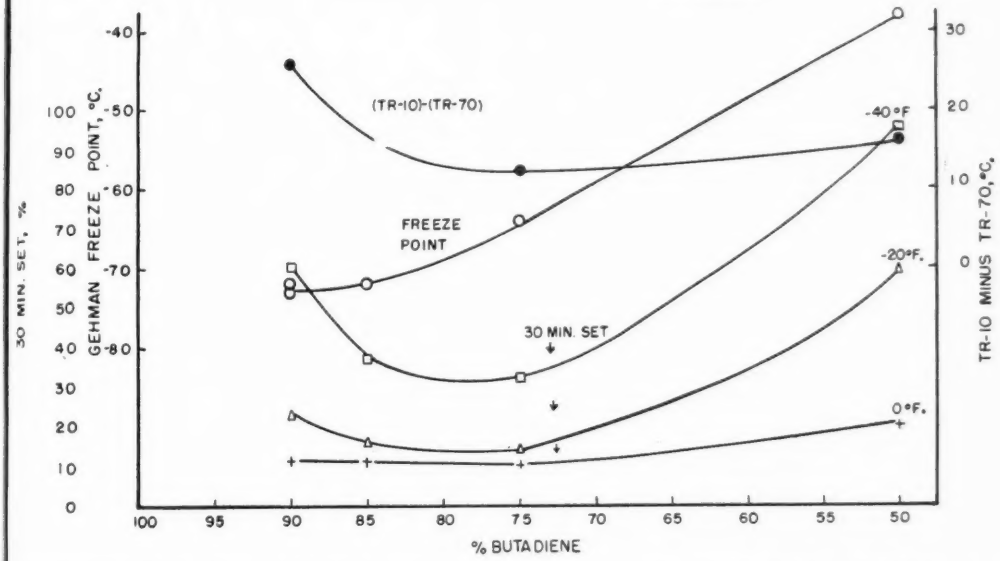

Fig. 2. (TR-10)-(TR-70) Values, 30-Minute Compression Set and Gehman Freeze Point Data for Stocks Prepared at 41° F. with Varying Amounts of Styrene and Masterbatched with 25 Parts of Tri-Octyl Phosphate

incorporation of 25 parts of tri-octyl phosphate, thereby increasing the temperature range over which the masterbatched polymer could be effectively employed. The control polymers showed freeze points of —49 and —48° C., respectively, for the GR-S-1002 and X-624 (See Table 3).

Compression Set and TR Tests

In compression set at 0, —20, and —40° F. vulcanizates of the masterbatches prepared from polymer made at 122° F. yielded similar results when the BD/S charge ratios were 100/0 to 75/25, but with the 50/50 BD/S charge ratio and at —40° F. test temperature a considerable increase in compression set, indicating an increased tendency toward crystallization, was observed. Similarly the polybutadiene and 85/15 BD/S masterbatches exhibited evidence of crystallization when tested at —40° F. (See Table 4 and Figure 1.)

For the masterbatches prepared from polymers made at 41° F. a tendency toward crystallization was noted for the masterbatches containing polymer made with 90/10 and 85/15 BD/S charge ratios, with an appreciable increase in compression set with masterbatches of polymers made with a 50/50 BD/S charge (Table 4 and Figure 2).

The crystallization tendencies of the masterbatched stocks of the 122° F. polymers decreased in the order of 100/0, 95/5, 50/50, and 75/25 BD/S, as indicated by the magnitude of the difference between the TR-10 and TR-70 values obtained from the temperature of retraction tests (Table 5 and Figure 1). For the vulcanizates of the masterbatches containing 41° F. polymers the crystallization tendencies decreased in the order of 90/10, 50/50, 75/25, BD/S (Table 5 and Figure 2). No masterbatch samples containing polymer prepared with monomer charges of 90/10 and 85/15 butadiene/styrene at 122° F. and with 100/0, 95/5, and 85/15 charge at 41° F. were available for testing.

Summary and Conclusions

The coprecipitation of 25 parts of tri-octyl phosphate added to latices prepared with varying monomer ratios and containing high ML-4 viscosity polymer appears to afford a method for securing masterbatches with varying processability, stress-strain properties, and low-temperature characteristics. By controlling the monomer ratio or by varying the quantity of tri-octyl phosphate, diversified masterbatched polymers with the desired low-temperature properties can be prepared.

TABLE 4. COMPRESSION SET TEST DATA FOR TRI-OCTYL PHOSPHATE MASTERBATCHES

Monomer Ratio BD/S	Compression Set, % At 0° F. 10 Sec.	30 Min.	60 Min.	6 Hr.	At −20° F. 10 Sec.	30 Min.	60 Min.	6 Hr.	At −40° F. 10 Sec.	30 Min.	60 Min.	6 Hr.
Polymers Prepared at 122° F.												
100/0	14.8	9.0	7.3	6.8	25.8	15.4	12.2	7.4	42.3	27.0	26.5	19.6
95/5	20.3	10.5	7.7	5.7	27.8	14.1	12.8	7.7	43.4	16.4	15.9	12.6
90/10	16.0	10.6	8.9	6.0	29.5	14.5	11.7	8.6	42.7	18.7	17.2	11.9
85/15	19.6	14.6	12.1	8.8	34.4	18.9	14.7	10.8	50.1	20.4	18.7	16.9
75/25	25.0	10.2	7.7	5.1	42.0	15.0	12.3	10.7	85.2	26.5	23.4	17.1
50/50	51.8	16.2	16.2	12.2	87.5	34.6	30.5	19.0	98.2	88.6	84.2	76.8
71/29*	46.0	14.3	11.7	8.2	76.8	41.9	26.0	14.8	89.6	73.3	69.5	55.3
Polymers Prepared at 41° F.												
90/10	22.0	11.5	11.2	7.1	48.4	23.3	20.6	19.6	72.1	60.1	58.4	57.4
85/15	17.3	11.4	10.4	8.9	26.1	16.0	13.2	7.9	62.4	37.1	33.9	31.1
75/25	24.1	10.3	9.2	7.7	45.3	13.7	12.5	11.1	96.0	32.3	27.5	20.3
50/50	62.0	19.8	18.8	16.3	95.0	59.7	50.3	29.6	98.0	95.2	94.2	89.1
75/25†	37.9	22.5	15.6	10.3	66.1	58.1	16.9	13.8	89.2	64.3	60.0	52.5

*GR-S-1002 control. †X-624 control.

TABLE 5. TEMPERATURE RETRACTION TEST RESULTS FOR TRI-OCTYL PHOSPHATE MASTERBATCHES*

Monomer Ratio BD/S	% Retraction:	Temperature, −° C. 5	10	20	30	40	50	60	70	80	90	Difference between TR-10 and TR-70
Polymers Prepared at 122° F.												
100/0		79	78	74	71	67	63	59	53	48	38	25
95/5		77	75	73	70	67	66	61	57	52	42	18
75/25		67	64	61	58	57	54	52	50	46	43	14
50/50		50	46	41	39	37	35	34	31	28	23	15
71/29†		52	50	48	46	43	41	38	35	31	22	15
Polymers Prepared at 41° F.												
90/10		73	69	64	62	59	54	50	43	38	30	26
75/25		63	60	57	54	53	51	50	48	44	43	12
50/50		44	41	36	32	30	27	26	25	23	19	16
75/25‡		52	50	48	46	43	41	38	35	31	22	15

*Data obtained on vulcanizates cured for 30 minutes beyond the optimum cure and samples were conditioned at −80° C. for 30 minutes before releasing. The temperature was raised 1° C. per minute.
†GR-S-1002 control.
‡X-624 control.

Test Conditions

Compounding recipe: 125 masterbatch polymer, 62.5 HAF black, 2.4 sulfur, 5 zinc oxide, 1.5 stearic acid, 1.00 Altax. The stocks were cured at 292° F. For the control polymers—100 polymer, 40 EPC black, 2.0 sulfur, 3.0 Altax, and 1.5 stearic acid.

Mooney viscosity: four minute reading, large rotor, 212° F.

Roughness according to procedure outlined by M. Mooney (11).

Mill processing index by method of Schade and Labbe (12).

Extrusion index according to the procedure of Garvey *et. al.* (13).

Stress-strain tests: OSR specification procedure January 1, 1949. Data obtained at 77 and 212° F. on vulcanizates nearest the optimum cure, as judged from the 300% modulus.

Hysteresis-temperature rise: Goodrich flexometer; 143 lb/sq.in. load, 0.175-inch stroke, 1800 r.p.m., 30-minute test at 212° F.

Flex-life: DeMattia flexometer; pierced specimens; data reported as number of flexures to produce 0.8-inch crack growth at 312 cycles per minute and 212° F.

Quality index: Ratio of test sample to flexures of GR-S at equal hysterimeter values.

Rebound: Goodyear-Healy pendulum method; angle of inertia 15 degrees; Shore hardness, five-second reading with Shore Type A durometer. Data are for the 50-minute cure.

Gehman low-temperature test as described in (14).

Temperature of retraction: Samples were elongated from 100 to 250% and conditioned for 30 minutes at —80° C. before releasing. Temperature was raised 1° C. per minute.

Compression set: Samples were conditioned for 22 hours at respective temperatures of 0, —20 and —40° F.

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(14) S. D. Gehman, D. E. Woodford, S. C. Wilkinson, Jr., *Ibid.*, 39, 1108 (1947).

New Products by Atlas Mineral

A line of coatings based on neoprene has been announced by Atlas Mineral Products Co., Mertztown, Pa.

These include Neobon, a mixed heavy rubber coating, Neelium, a high solids liquid coating, and Elprene, a liquid maintenance coating. Available in gray and black colors, they can be applied to metal or concrete surfaces over a Neobon priming system.

Also introduced are Urefoam and Cyofoam, rigid and flexible foamed-in-place cellular isocyanate plastics for use as thermal and sound insulation and for reinforcing and filling voids to produce strong, lightweight structures.

Fatigue of Rubber with Two-Way Stretching[1]

By S. D. Gehman[2] *and* R. P. Clifford[2]

FLEXING failure of rubber in service is generally due to repeated complex strains. Laboratory flex testing has usually been based on a simple extension and retraction cycle.

A machine has been constructed and used to study the fatigue or flex life of rubber compounds subjected to biaxial strains of controlled amplitude and phase relations. Alternate biaxial straining gave flex life *vs.* cure curves with a broad maximum for a range of cures. A means is thus provided for selecting an optimum cure range for this type of flex life for each polymer, and polymers can be compared at their optimum cures for flex life.

DYNAMIC fatigue of rubber, failure under cyclic deformations, has many obscure characteristics in spite of the attention which it has received. Dillon[3] prepared a review of published work and analyzed the results and methods of testing. The incentive for laboratory fatigue testing of rubber came with efforts to eliminate groove cracking in tire treads by improvements in the tread compounds. Laboratory flex tests were developed which usually used cam operated mechanisms for cyclically stretching rubber test strips.[4,5]

It was soon recognized that the fiber structure in tread stocks due to stretching had an initimate connection with the fatigue characteristics observed.[6,7] The deformations of the rubber on a tire are more complicated than linear stretching and retraction and may include localized cycles of biaxial deformations in which the principal strains have varying phases and relative amplitudes. The fibering cannot be as simple as in the case of linear stretching, especially since any fiber structures formed require a finite time for relaxation. It should, therefore, be pertinent to study the fatigue of rubber under various conditions of biaxial straining. This study is desirable both to understand better the nature of fatigue with tire treads and sidewalls and to secure more generalized information on fatigue of rubber.

A relatively simple single station machine was designed and built so that a sheet test piece could be subjected to biaxial cycles of strain of controlled amplitudes and phases. Fatigue results secured with this device were interesting and instructive.

Description of Biaxial Flex Test Machine

Figure 1 is a photograph of the machine. Four jaws mounted at 90-degree intervals are moved by a system of push rods which bear against a pair of Micarta cams on a central vertical shaft. The cams are designed so that it is possible to determine the phase of the motions of the two sets of jaws by the relative positions of the cams on the shaft. The amplitude for each set of jaws

Fig. 1. Two-Way Flexing Machine; Provisions for Regulating Phase of the Motions of the Two Sets of Jaws, Amplitude, and Temperature of Test Are Included

can be varied by changing cams. The stretch of the rubber can also be varied by changing the size and shape of the test piece. The speed used was 240 R.P.M. for the cam shaft.

The photograph shows a light source and phototube mounted above the machine. A mirror was placed under the test piece. When the test piece failed, light was reflected to the photocell by the mirror, and the machine was stopped by a relay circuit. This device was not used in the work here reported where the end-points were determined by stopping the machine and measuring the crack growth.

When it was desired to operate at elevated temperatures, short metal cylinders, two inches in diameter, heated with cartridge heaters were mounted above and below the center of the test piece in close proximity to it. The voltage setting for the heaters to secure the desired test piece temperature was then determined by means of a thermocouple attached to a test piece.

Test Procedure

The test pieces were 3½-inch squares cut from molded, vulcanized sheets, 0.04-inch thick.

The test piece was mounted in such a way as to have two-inch unstretched length between each pair of jaw faces. The cams used provided a maximum traverse of

[1] Presented before the Division of Rubber Chemistry, A. C. S., New York, N. Y., Sept. 15, 1954. Contribution No. 207, Research Laboratory, Goodyear Tire & Rubber Co. Work performed as part of research project sponsored by Federal Facilities Corp., Office of Synthetic Rubber, in connection with the Government Synthetic Rubber Program.

[2] Goodyear Tire & Rubber Co., Akron 16, O.

[3] "Fatigue in High Polymers," p. 219, in "Advances in Colloid Science," Vol. III. Interscience Publishers, London (1950).

[4] L. V. Cooper, *Ind. Eng. Chem. (Anal. Ed.)*, 2, 391 (1930).

[5] E. T. Rainier, R. H. Gerke, *Ibid.*, 7, 368 (1935).

[6] W. F. Busse, *Ind. Eng. Chem.*, 26, 1194 (1934).

[7] J. T. Fielding, *Ibid.*, 35, 1259 (1943).

two-inches for each set of jaws. For most of the work, the settings which were used gave a cycle of —25 to +75%. The —25% means that the jaw faces had a minimum separation of 1¾ inches so that the original sheet length of two-inches was reduced 25% at the end of the stroke by bending of the sheet. The specimen was not actually subjected to compression.

All of the tests were cut growth tests. The center of the test piece was pierced carefully with a needle, diameter 0.030-inch using a sheet metal template as a guide. The end-point for failure was taken to be a crack length of ½ inch.

Compounds Used

The compound formulae used are given in Table 1.

TABLE 1. COMPOUND FORMULAE

	A	B	C	D	E	F	G	H	I
GR-S 1500	100	100	100	100					
1005					100				
1000						100	100		
X628 (Oil MB)								125	
Smoked sheet									100
HAF Carbon Black	50		50		50		50	62.5	50
MPC Carbon Black		50							
P-33 Carbon Black				50					
MT Carbon Black						50			
Zinc oxide	5	3	3	3	5	5	5	3	5
Sulfur	1.75	1.6	1.6	1.6	1.75	1.75	1.75	1.75	1.75
Stearic acid		1	1	1		1	1	2	1
Diphenyl guanadine	0.25	0.7	0.7	0.7	0.25	0.25	0.25	0.45	0.25
Mercaptobenzothiazole disulfide		0.5	0.5	0.5				0.6	
Amax*	0.75				0.75	0.75	0.75		0.75

*N-diethylene oxy-2-benzothiazyl sulfene amide. (R. T. Vanderbilt Co., New York, N. Y.)

Discussion of Test Results

A series of tests was run in which the phase of biaxial strains was varied. The phase relations are illustrated in Figure 2. The results are given in Table 2.

TABLE 2. EFFECT OF PHASING OF BIAXIAL STRAINS ON FLEX LIFE

Compound A Cure, 55 Min. @ 275° F.; Cycle, −25% to +75; Speed, 240 R.P.M.

Out of Phase Relation, Degrees	No. of Specimens Tested*	Ave. Cycles for Failure	Standard Deviation	Surface Temp. Rise °F.	Relative Flex Life
One way	5	34,956	8,200	10	100
0	12	21,552	7,455	10	62
90	12	21,466	9,778	20	62
180	11	3,342	1,402	70	10

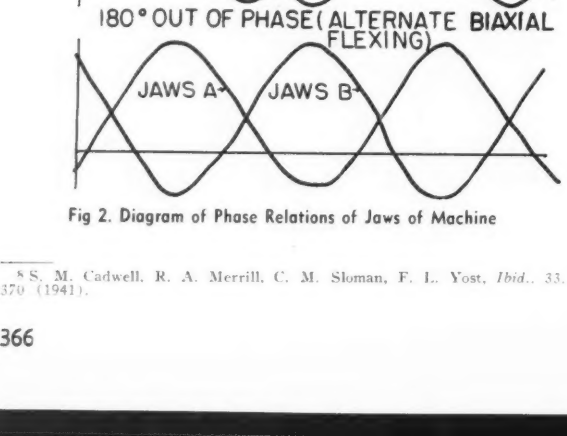

Fig 2. Diagram of Phase Relations of Jaws of Machine

It is noteworthy that biaxial straining with alternate application of force in the two directions decreased the flex life by a factor of 10 from that for one-way stretching; with the in-phase condition the decrease in flex life was only by a factor of 1.6. It is quite possible that these factors will vary with different types of rubber and types of compounding. The large heat generation which occurred with alternate biaxial stretching probably accelerated the failure. There is evidence here of a connection between hysteresis and fatigue and the possibility for a flex test which brings hysteresis more definitely into the test.

Weakness Transverse to Fibering

The implications of these results in regard to the relation of fatigue and rubber structure are intriguing. The early work on laboratory fatigue testing soon brought out the fact that fatigue failure was accelerated if the test specimens returned to zero strain.[4-6, 8-10] The explanation has been that upon return to the zero strain position, the fatigue resistant fibrous structure in tread compounds induced by stretching has more time to relax.[3, 6] The low fatigue life observed here with alternate stretching in two perpendicular directions may be interpreted as confirming the persistence of a fiber structure upon retraction and a weakness upon stretching transverse to fiber structure. That is, the fiber structure built up by stretching in one direction was not entirely dissipated before the rubber was stretched at right angles to this direction. This condition resulted in low fatigue life since polymers are notoriously weak in the direction transverse to fibering.

[8] S. M. Cadwell, R. A. Merrill, C. M. Sloman, F. L. Yost, *Ibid.*, 33, 370 (1941).

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Time at Zero Strain Important

Return to zero strain at frequencies usually used in flex testing may not give the fiber structure time to relax completely. There should, however, be more relaxation than occurs if zero strain is not reached. This explanation of the low flex life observed with zero minimum strain has not been entirely satisfactory because fatigue life has generally been found to be independent of frequency. Intuitively, if the flex life for alternate biaxial stretching is dependent on fibering and relaxation of fibering, and the test is carried out with a sufficiently long waiting period between the two perpendicular strains, the flex life should be about the same as for one-way stretching. Simply running the machine at reduced speed is not sufficient to test this point because it introduces effects of static fatigue and variations in fibering due to different rates of stretching.

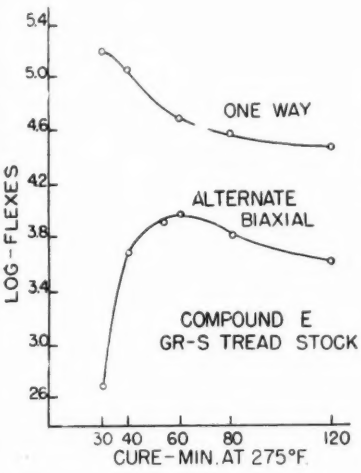


Fig. 3. Effect of Cure on One-Way *vs.* Alternate Biaxial Flexing of GR-S Tread Compound

Thus, as has been usually reported for one-way stretching, fatigue life with alternate biaxial stretching was found to be essentially independent of speed in the range from 240 to 5 R.P.M. for Compound A. To prove an effect of fiber relaxation at zero strain on flex life from results at different cycling speeds, a sort of "square wave" cycle would be required in which the stretching and retraction times remained constant, and only the waiting time at zero strain varied.

The large hysteresis associated with the disintegration of the fibering in one direction and its formation in a perpendicular direction is, no doubt, a reflection of the relatively severe changes in molecular configurations required. All such changes may be expected to be accompanied by the degradation of some of the mechanical energy to random molecular motions or heat.

In-Phase Biaxial *vs.* One-Way Straining

In-phase biaxial straining evidently produces a type of fibering with inferior fatigue resistance to that produced by one-way stretching. With equal amplitudes for the two directions, it corresponds to a compression test; the load is applied perpendicular to the sheet. Compression fatigue life has also been shown to have a minimum value for the zero minimum strain condition.[8,9]

In view of the different fiber structure for compression, the fatigue curve for compression flex life *vs.* compression strain should probably not be regarded as a continuation of this curve for linear stretching. The maximum flex life observed for a certain optimum compression strain may be interpreted as characteristic of this fiber structure rather than being regarded as an unexplained second maximum in the tensile fatigue curve. The maximum, of course, represents the most favorable balance between static and dynamic fatigue.

Effect of Cure on Flexing with Amplitude Varied

Figure 3 illustrates the striking results secured with alternate biaxial stretching when the fatigue tests are carried out for a range of cures. The flex life for one-way stretching *vs.* cure showed the usual falling off from low to high cures. This evidence does not provide any information as to what cure should be used for best fatigue performance. Furthermore, it is difficult to compare the flex life of different polymers because of the large effect of cure and the difficulty of selecting the cure at which they should be compared.

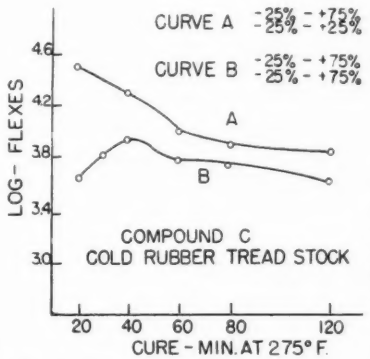


Fig. 4. Reduced Amplitude Changes Flex Life *vs.* Cure Curve from Alternate Biaxial to One-Way Stretch Characteristics

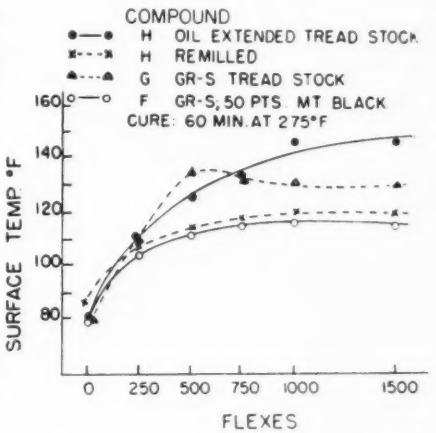


Fig. 5. Variation in Surface Temperature on Two-Way Stretching for Different Compounds

With biaxial stretching, on the other hand, flex life for the low cures was very poor. The curve rises to a plateau representing a suitable range of cures for good flex life and then declines for the overcures. Tentatively, it may be assumed that the low cures show poor flex life either because of deficiency of fiber structure or because higher internal friction leads to longer persistence of fiber structure. Or a good cure may be required to develop fatigue resistance transverse to fiber structure. It is not possible to decide from this evidence which alternative is correct. The long flex life at low cures with one-way stretching has nothing to do with fiber structure and is simply a consequence of the permanent set assumed by the test piece. The high cures show poor flex life because static fatigue comes more prominently into the picture as progressive cure decreases the ultimate elongation.

Figure 4 shows that reduction in the amplitude of one of the alternate biaxial strains caused the flex life *vs.* cure curve to revert to the characteristics secured with one-way stretch.

Surface Temperatures for Various Compounds

In Figure 5 are plotted curves showing the build-up of the surface temperature, measured with a thermocouple, during alternate biaxial stretching for a variety of compounds. The effectiveness of remilling the oil polymer compound for reducing the surface temperature

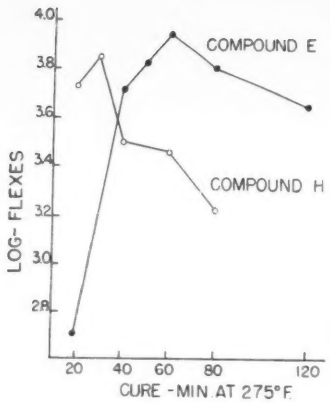
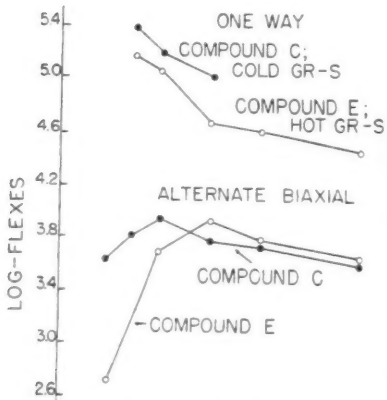


Fig. 6. Flex Life vs. Cure for Compounds E and H *(Left)*

Fig. 7. Flex Life vs. Cure, One-Way and Two-Way Stretching, for Compounds C (LTP GR-S) and E (122° F. GR-S) *(Far Left)*



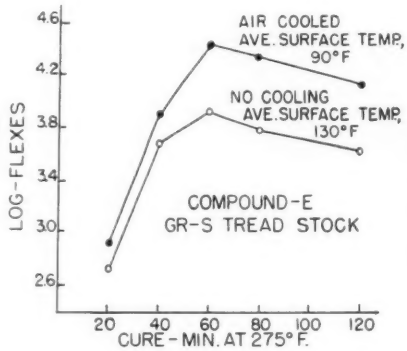


Fig. 8. Comparison of Flex Life for Compound E, with and without Surface Cooling

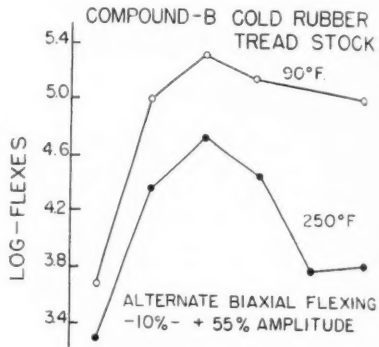


Fig. 9. Flex Life at Various Cures for Compound B (LTP GR-S) When Tested at 90 and 250° F.

is especially noteworthy and may be explained as due to a decrease in either the fibering tendency or the persistence of fibering either because of better black dispersion, molecular breakdown, or both. Thermatomic black gave the lowest surface temperature and is known to have the least fiber producing quality in rubber. Some flocculation or agglomeration of the black is probably required for extensive fibering.

Flex Life of LTP and Regular GR-S

Additional flex life *vs.* cure curves are shown in Figure 6. The peaks here are unusually sharp. In Figure 7 a comparison is made of the flex life of a hot GR-S tread compound and a cold GR-S tread compound under conditions of one-way stretch and of alternate biaxial stretching. The cold rubber compound shows the expected superiority with one-way stretching. With alternate biaxial stretching, the superiority of the cold rubber compound is apparent only for the lower end of an acceptable curing range.

Heat Build-Up Effect on Flex Life

The effect on the flex life of the heat build-up during alternate biaxial flexing could be determined by comparing results with and without cooling of the surface with an air blast. The results of such an experiment are shown in Figure 8. The reduction of the surface temperature from 130 to 90° F. by forced air cooling caused an appreciable increase in the flex life.

The reduction in flex life brought about by raising the temperature of the central area of the sheet to 250° F. is illustrated in Figure 9. To the extent that the increased temperature would reduce the relaxation time for fibering, it might improve the biaxial fatigue life. But any such benefit is evidently more than counterbalanced by the decrease in the fibering when the temperature is raised or by the general weakening of the molecular structure.

Summary and Conclusions

Not only is the biaxial stretching technique enlightening in regard to the mechanism of fatigue in rubber, but the results secured in these experiments are encouraging for the development of a biaxial flexing test adapted for giving useful technical results.

In-phase biaxial straining reduced the flex life somewhat in comparison with one-way stretching. Alternate biaxial straining was the most severe phase condition and reduced the flex life of an LTP GR-S tread compound notably. This type straining was accompanied by high hysteresis losses, as shown by the temperaure rise of the surface of the test sample. This rise was sufficient to affect the flex life so that for this type of deformation there was a definite dependence of flex life on hysteresis.

Since alternate biaxial straining gave flex life *vs.* cure curves with a plateau for a range of cures, it provides a means for selecting an optimum cure range for this type of flex life for each polymer. In this way, polymers can be compared at their optimum cures for flex life.

The authors wish to express their thanks to The Goodyear Tire & Rubber Co. and to H. J. Osterhof for permission to publish this work.

Kleinert Gets Management Award

I. B. Kleinert Rubber Co., New York, N. Y., was the recipient of the Morris H. Palmer Award for leadership in progressive industrial management bestowed by the Queens County Management Club, an affiliate of the National Association of Foremen, on November 15.

According to Robert E. Murphy, vice president of American Chicle Co., who made the award, "The company has been a pioneer in promoting understanding between management and labor, and maintains active memberships in management groups, safety councils, and technical societies, as well as community groups and drives." Roland H. Guinzburg, executive vice president of Kleinert, accepted the plaque on behalf of his firm.

The Extrusion of Film and Sheeting[1]

By George P. Kovach[2]

MORE and more film and sheeting, both rigid and flexible, are manufactured today by the extrusion process. A good illustration of the advantages of the extrusion process over previous methods is provided by cellulose acetate sheeting.

This sheeting was made originally by wet compounding the raw material into a dough in a heavy-duty dough mixer. Next, the dough was milled to remove some of the solvent, and the milled slabs were pressed into a block. This block was then cut into sheets by a slicer or skiver. Since these sheets still contained solvents, they had to be cured, a process which took three to eight weeks. After curing, the sheets were warped and had to be press-polished.

Today, the cellulose acetate compound is made by extruding the blend of cellulose acetate flake and plasticizers through a compounding-extruder. This finished compound is then extruded into sheeting which has a satisfactory finish for most end-uses.

Not only did the extrusion method eliminate a lot of steps in the manufacture of the sheeting, thereby resulting in lower capital investment and much lower working capital requirements, but it also extended the useful range of the product. Thicknesses below approximately 0.007-inch could not be made by the skiving method; whereas extruded film can be made down to 0.0008-inch thick.

The extrusion of film really came into its own when polyethylene appeared on the market, and the usefulness of polyethylene film as a packaging material skyrocketed it into prominence. Extrusion is the only practical method for the manufacture of polyethylene film, and this product has given birth to an entire new industry.

During the past two or three years the growing importance of sheet forming by vacuum and other methods has multiplied the demand for thermoplastic sheeting. There is no end in sight to this growth of the forming industry and its use for sheeting. This growth has been based, to a large extent, on the availability of reasonably priced extruded sheeting.

Even plasticized PVC sheeting, which can be formed at high speeds on calenders, is being extruded in many cases because it has become possible to do postforming operations (such as vacuum forming, printing, and trimming) directly from the extruder and in this way compete with calendering.

The main reasons for the interest shown by vinyl processors in extrusion are the improvement in quality of the film obtained, and the extension of the useful range of vinyl film into gages down to 0.001-inch. It is well known that calendered film below 0.003-inch thick has very poor strength, and a good deal of harm has been done to the vinyl industry by the marketing of products made from a thin and flimsy film without sufficient tear strength.

Table 1 gives some idea of the improvement in tear strength possible by going to extrusion.

TABLE 1. COMPARISON OF PROPERTIES OF CALENDERED AND EXTRUDED VINYL FILMS AND EXTRUDED POLYETHYLENE FILM FOR ARMY PISTOL BAGS

	Gage, Mils	Elmendorf Tear* Grams	Elmendorf Tear* Lbs. In.	Elongation at Break,* %	Tensile Strength,* Psi.	Bags / Lb. Film
Polyethylene:						
Extruded...	4.0	33	340	380	1,650	24
Vinyl:						
Extruded...	2.5	123	1,850	240	2,600	32
Calendered	4.0	44	380	230	2,550	16

*Values are averages of results both with and against the film grain.

A comparison of the properties of the same film formulation when extruded, calendered, or cast to a thickness of two mils is given in Table 2:

TABLE 2. COMPARISON OF PROPERTIES OF 2-MIL CALENDERED, ORGANOSOL CAST, AND EXTRUDED VINYL FILMS (RESIN: PLASTICIZER RATIO, 100:45)

	Calendered	Cast	Extruded
With Grain:			
Tensile strength, psi.	2,600	2,700	2,800
Elongation at break, %	200	170	160
Elmendorf tear, lbs./in.	130	820	750
Against Grain:			
Tensile strength, psi.	2,000	2,500	1,300
Elongation at break, %	120	150	180
Elmendorf tear, lbs./in.	210	560	540
Average tear, lbs./in.	170	690	645

Besides these tremendous gains in strength and the extension of the useful gage range from 0.003-inch down to 0.001-inch and lower, another advantage can be gained by extrusion over calendering. All calendered PVC film has a frosty appearance due to the nature of the calendering process. By extrusion, a completely clear,

[1] Based on a paper presented before the National Technical Conference, Society of Plastics Engineers, Inc., Toronto, Ont., Canada, Jan. 28, 1954.
[2] Foster Grant Co., Leominster, Mass.

THE extrusion of plastics film and sheeting, both rigid and flexible, is expanding at a rapid rate because of the lower equipment cost, as compared with calendering, and the wider range of properties and dimensions of the finished product.

The importance of die and screw design for the extrusion of rigid sheeting and these factors plus control of gage and wrinkling for flexible polyethylene sheeting extrusion are discussed.

The extrusion of flexible PVC film involves consideration of resin characteristics and compounding ingredients, processing, and several important mechanical factors connected with the design and operation of the extruder.

smooth, and glossy film can be made which lends itself extremely well to display packaging, transparent garment bags, plastic storm windows, and many other applications.

We have now covered in a very sketchy way the reasons for the growing importance of extrusion as a method for manufacture of film and sheeting. Let us discuss the methods and problems involved in the different extrusion processes.

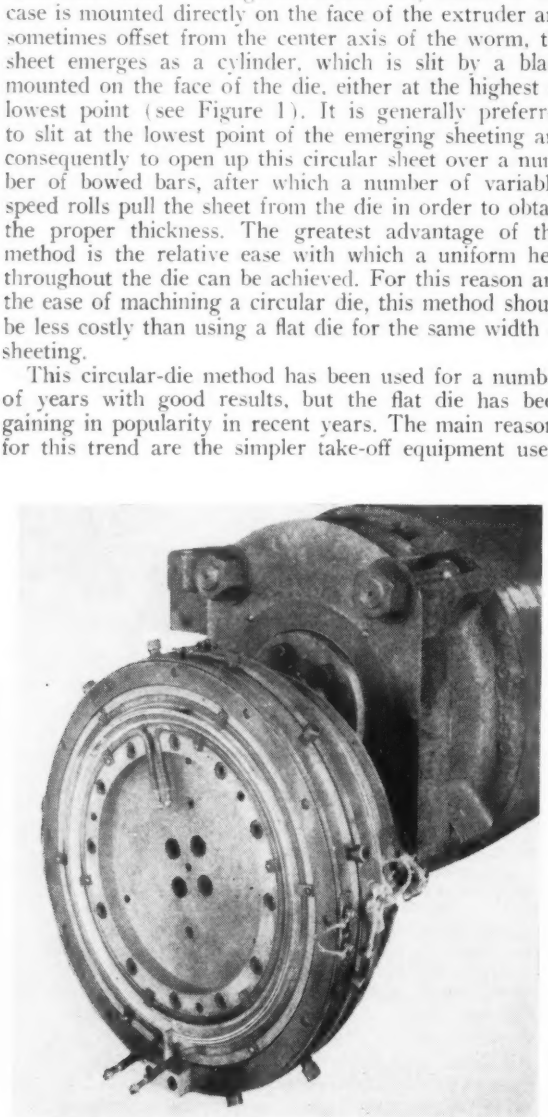
From the point of view of products, we can divide the field into two major groups: (1) rigid film and sheeting and (2) flexible film and sheeting. The first group has seen the most technical advances in the last three years.

Extrusion of Rigid Sheeting

Die Design

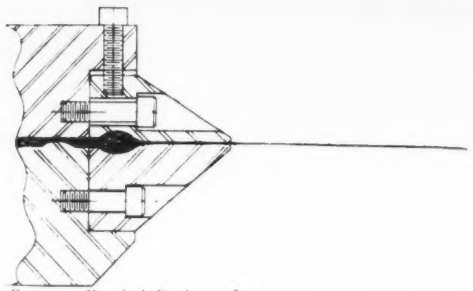
Cellulose acetate and butyrate sheeting have been extruded for many years, and both circular and flat dies have been used. Through a circular die, which in this case is mounted directly on the face of the extruder and sometimes offset from the center axis of the worm, the sheet emerges as a cylinder, which is slit by a blade mounted on the face of the die, either at the highest or lowest point (see Figure 1). It is generally preferred to slit at the lowest point of the emerging sheeting and consequently to open up this circular sheet over a number of bowed bars, after which a number of variable-speed rolls pull the sheet from the die in order to obtain the proper thickness. The greatest advantage of this method is the relative ease with which a uniform heat throughout the die can be achieved. For this reason and the ease of machining a circular die, this method should be less costly than using a flat die for the same width of sheeting.

This circular-die method has been used for a number of years with good results, but the flat die has been gaining in popularity in recent years. The main reasons for this trend are the simpler take-off equipment used,



National Rubber Machinery Co.

Fig. 1. Electrically Heated 15-Inch Diameter Circular Extrusion Die with Slitting Knife



Eastman Chemical Products, Inc.

Fig. 2. Cross-Sectional Drawing of Adjustable Die Lips for Extruding Cellulose Ester Sheet. Section Shown Is through Center of Die

since the sheeting is already flat when emerging from the die; the possibility of doing post-forming operations like embossing or vacuum forming right at the die, thus utilizing the heat which the sheeting carries from the extruder; and the extrusion of modified polystyrene, which stiffens much faster than cellulose ester sheeting and would be difficult to transform from the circular to the flat shape. Vacuum forming has increased the demand for thicker sheets which can be handled easier when flat.

For the above reasons there is no doubt that we will see a lot of development work on flat sheet extrusion dies in the near future. Even today rigid sheeting up to 60 inches in width is being extruded very successfully in many installations across the country. As mentioned before, one of the great difficulties in the design of a flat die is the necessity of accurate heat control in individual zones, a system which requires rather expensive instrumentation.

The basic problem in the design of a good flat die is the achievement of uniform pressure across the width of the die. This is usually done by restricting the flow of the material by ridges running across the width of the die, sometimes higher in the center and tapering down toward the edges (or made adjustable). Another method employs the so-called manifold principle where the material enters a reservoir running across the width of the die, from which it should emerge with fairly uniform pressure.

Sometimes a combination of both principles is used, as shown in Figure 2. From the body of the die the material enters the lips, of which the upper one is usually made adjustable. The length of the die lip or land depends entirely on the thickness of the sheet to be extruded; the heavier sheets require longer lands. Since the pressures developed in a die of this sort are considerable, its construction must be rather heavy.

Screw Design

Cellulose esters require extensive working in the extruder to reduce the number of gel particles and to deliver uniformly heated stock to the die. It is desirable, therefore, to use a screw which has a final metering or heating section in front where the material is squeezed through a restricted section. This result can be achieved by using either a metering screw similar to the type used for nylon, or a torpedo screw, many modifications of which have been tested.

It is fortunate that these types of screws have been found to be basically very satisfactory for the extrusion of modified polystyrene and styrene copolymers. Generally, a neutral screw is used (i.e., a screw without internal heating or cooling) together with a sufficient number of screens to create enough back pressure to prevent surging. With the cellulose esters, drying of the compounds

before extrusion is of greatest importance. Here the hopper-dryers which have come on the market during recent years do a very satisfactory job. The take-up equipment may consist of a conveyor belt; more often a set of rolls of controlled temperature and speed are used, since some smoothing of the sheet surface can be achieved by a highly polished heated roll right at the die.

Extrusion of Flexible Sheeting

The extrusion of flexible film and sheeting deals primarily with two groups of materials; polyethylene, and plasticized polyvinyl chloride and its copolymers. Even though the basic methods used for the extrusion of both groups of materials are the same, there is sufficient difference in their behavior to pose completely different problems to the extruder.

Polyethylene Extrusion

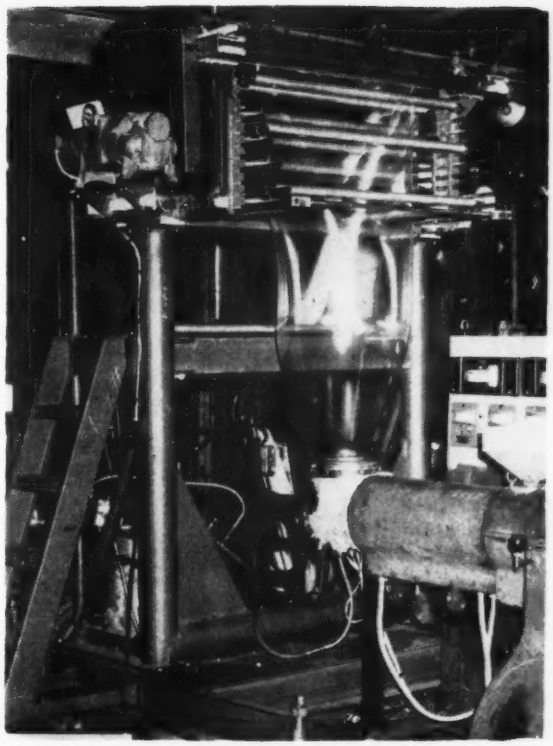
Polyethylene is a material which is bought by the extruder in granular form and, in most cases, does not have to be modified for use in the extrusion of film. Polyethylene has relatively excellent heat stability and very good flow properties under heat and pressure. The problems involved in its extrusion, therefore, reduce themselves to high and efficient output, good gage control, heat control, and satisfactory take-up and winding equipment.

The output of the extruder depends on two factors. First, the cylinder has to be of sufficient length to bring a large amount of material to a uniformly heated stage. Since polyethylene is an extremely poor conductor of heat, a fairly shallow screw will be required to transmit the heat from the cylinder walls through the material.

The second factor is screw design. The screw found most efficient is a full flighted type with constant pitch and having a conventional compression-heating section and a flighted metering section in front. The flights of the metering section are very shallow, preferably below 0.100-inch. This metering section extends 3-4 flights back from the front end of the screw, depending on the size of the extruder. Between the screw and the die is the breaker plate holding the screen pack. With polyethylene, owing to its low viscosity under heat, a high amount of screening (usually down to 120-mesh size) is generally desirable. As for the method of heating the cylinder, electric heating has been found satisfactory by most extruders of polyethylene.

Modern Plastic Machinery Corp.

Fig. 3. Extrusion of Polyethylene Film through a Flat Die, Showing Cooling, Take-up, and Winding Operations



National Rubber Machinery Co.

Fig. 4. Extrusion of Tubular Polyethylene Blown Film through a Cross-Head Die

DIE DESIGN. Here again, both circular and flat dies are used. The flat dies are gaining in popularity except when a tubular extrusion is required as the end-product. A flat die will produce film of good uniformity, which is relatively easy to handle through cooling, take-up, and winding operations without too many wrinkling or distortion problems (see Figure 3). One of the advantages of flat film extrusion is the possibility of extruding directly into a laminating station for lamination of the film to paper, cellophane, and other materials. These laminations have become large volume items during recent years and have filled many packaging needs, particularly for the Armed Forces.

This demand for high-speed production of polyethylene paper laminates has resulted in many refinements in extruder and die design and particularly in instrumentation for heat control.

TUBULAR FILM. For extrusion of tubular polyethylene film, a cross-head die is used, and the film extruded vertically upward. Horizontal extrusion is impractical because of gravitic distortion of the soft film. Some successful installations have been made where the film is extruded downward, but this method puts upper and lower limits on the thicknesses which can be handled and increases installation costs.

A typical installation for the extrusion of tubular film is shown in Figure 4. The film is pulled from the die by a pair of driven spring-loaded rolls. Between the die orifice and these rolls is a completely closed bag of film

with air injected into this space from the bottom of the die through the mandrel. Since this air space is completely enclosed by the die, the moving tubular film, and the rolls on top, no further air is needed once the "bubble" is expanded to the wanted size.

The main advantage of this method becomes obvious at this point: one die will produce a variety of film widths by varying the amount of gas trapped in this closed space. Since the opening of the die orifice is constant, the film gage is determined entirely by the speed of the overhead rolls in relation to the amount of polyethylene extruded. It is obvious, therefore, that the speed of these rolls must be extremely uniform and subject to fine control.

Gage Control. The biggest problem in the extrusion of tubular film is to hold a uniform gage across both the circumference and the length of the tube. Lengthwise gage variations result from non-uniform extrusion speed or "surging," or uneven speed of the overhead "pinch-rolls." Surging is due generally to improper screw design, insufficient control of stock temperature, or insufficient back pressure in the extruder which can be corrected by the addition of either more or finer screen cloth.

Variations of gage around the circumference of the tube can be caused by many factors. Since the orifice of the die is at a 90-degree angle from the face of the extruder, part of the stock has a longer way to travel through the die than does the other part. Therefore the temperature of the die body has to be very uniform and very close to the temperature of the stock emerging from the extruder. This factor is very important.

The second cause of circumferential gage variations is the pressure differential between the stock which has the shorter travel and the stock which has to travel around the mandrel and then toward the orifice. This differential can be sufficient to bend the mandrel out of its center-line position. Each of these factors may result in a heavier film gage on the side near the extruder than on the side away from the extruder. This condition usually can be corrected by careful balancing of heats and by varying the adjustable top ring of the die.

As mentioned previously, the tubular film is not extruded to the final gage; the die orfice is 10-30 times that of the desired gage. Therefore the final gage is obtained by stretching the hot film outside the die. It is obvious that the film has to be of absolutely uniform temperature as it leaves the die in order to stretch evenly. Room temperature will have a strong influence on the stretch, and provisions must be made to prevent drafts which would cool parts of the film before it is fully stretched. Many intricate systems have been patented to cool and stretch the film uniformly.

Wrinkling. Not only is it necessary to have proper gage control for a commercially acceptable product, but wrinkling during winding becomes a real problem if the gage is not uniform across the width and leads to a distorted film which would be rejected for most applications. Besides gage variations, two other factors can cause wrinkles and distortions of the film.

First, the round "bubble" of film has to be flattened down to go through the pinch rolls. If this flattening is done suddenly, the film in the center has to travel much farther than the film at the edges, and, therefore, the edges will wrinkle. To prevent this wrinkling, the bubble has to be flattened gradually before reaching the pinch rolls. This flattening is done by means of a number of lightweight or driven rolls mounted on a V-shaped frame leading toward the pinch rolls.

The second factor which can cause distortion and wrinkling is insufficient cooling of the film before it reaches the pinch rolls. Therefore, the distance between the die and the pinch rolls must be in accordance with the output speed of the extruder and the thickness of film to be extruded.

After the air has been squeezed out of the bubble by the pinch rolls, the film is ready to wind if it is to be used in tubular form. Some installations are using one of the pinch rolls to wind against; in other words, the core on which the film is to be wound turns against the pinch rolls. This method has the advantage that, if the film is brought into the pinch rolls without wrinkles, there is no opportunity for wrinkles to form before the winding. On the other hand, the film is pulled up to the pinch rolls under tension, and if it is wound right there, these tension strains will cause shrinkage and, therefore, distortion in the roll. To avoid these strains the film should be given a chance to cool without tension before being wound. A number of devices such as slat expanders, edge guiders, dancer rolls, and others, can be used to wind the film under light but controlled tension and without wrinkles.

PVC Extrusion

All the problems discussed in connection with the extrusion of tubular polyethylene film also apply to some degree to the extrusion of plasticized PVC film. In extruding PVC film, however, many of these mechanical problems become more pronounced and a multitude of chemical problems is added.

Formulation. Let us take a look at the raw material first. Whereas polyethylene is supplied to the extruder in granulation or pellets of fairly uniform quality, with PVC we are faced with an endless number of possible formulations, a number of different mixing methods, varying degrees of hardness, and many other variables.

Nevertheless the major differences between polyethylene and PVC are the very limited heat stability and lower degree of flow of the latter, and all problems connected with its extrusion into film stem from these two shortcomings.

A PVC compound generally consists of the following components: (1) polyvinyl chloride or a copolymer thereof; (2) plasticizer or usually a mixture of plasticizers chosen to get the desired properties in the end product; (3) heat and light stabilizers; and (4) fillers, pigments, and lubricants.

The choice of resin should depend primarily on its heat stability at the processing temperature. The second consideration in the choice of the proper resin is the method to be used for blending and fusing. Some resins lend themselves to the so-called "dry blending process." These are PVC resins of controlled particle size and shape which are able to absorb completely the plasticizers at elevated temperatures and, after this hot blending, give a free-flowing mix which can be fed directly into the extruder.

This blending is usually carried out at 180-220° F. and has the tremendous advantage that the compound has not been subjected to fusing temperatures before entering the extruder and therefore possesses a higher heat resistance during extrusion than does a prefused compound. This hot blending can be carried out in ribbon blenders, double-arm blenders, or speed-mullors. The disadvantages of this process are the limitation in the percentage of plasticizer which can be completely absorbed by the resin; the difficulty of thoroughly dispersing fillers and pigments; and the use of part of the extruder barrel for fusing of the blend, which makes it more difficult to control the desired stock temperature because of very high frictional heat build-up.

If, because of the above-mentioned difficulties, the

stock has to be fused before entering the extruder, this fusing can be done in a separate extrusion operation from which the fused stock can be diced or pelletized, or in a standard Banbury-type mixer and/or a mixing mill.

Compared to standard vinyl formulating practices, the following differences have to be kept in mind for film:

(1) The heat applied in film extrusion is higher and over a longer period than in any other type of processing. Therefore only the most effective heat stabilizers should be considered, regardless of cost, since the success of the operation depends on how long a run can be made before decomposition of the compound in the hottest parts of the die. Lead phosphite for opaque compounds and tin stabilizers, particularly tin mercaptides, for clears are probably best.

(2) Since most extruded film is very thin and the surface-to-volume ratio very high, only the least volatile plasticizers should be considered. For further improvement in heat stability a small percentage of an epoxy-containing plasticizer should be included in the formulation.

(3) Since the stock has to be pushed by the extrusion screw through relatively long and restricted die passages, no fillers or pigments which reduce flow to any extent should be employed.

(4) The greatest danger to the success of the film extrusion operation is sticking and consequent decomposition of the stock in the hot die (350-400° F.). In addition to giving due consideration to this factor in the design and machining of the die, the sticking can be reduced to some extent by lubricants which are effective at these high temperatures. Metallic soaps and many synthetic waxes will be of benefit. The problem becomes more difficult when an entirely clear transparent film is being formulated. Only very small amounts of waxes can be tolerated without causing surface bloom, and it is questionable whether such non-blooming quantities of wax are effective.

A further complication arises from the fact that most lubricants are more compatible with the vinyl compound at the extrusion temperature than at room temperature. This problem can be alleviated somewhat by choosing plasticizers which have some lubricating properties. Lubrication is important in the finished film, too, to prevent sticking of the smooth and glossy film surfaces to each other when rolled up tightly. Some anti-blocking agents are available which, when used in sufficiently small amounts, will not interfere with clarity.

The extrusion of opaque vinyl films in gages of 0.001-0.0025-inch poses a problem in achieving opacity. Rather large amounts of titanium pigments must be used, and it is advisable to predisperse these pigments to get the fullest benefit from them and to remove the moisture they may contain. If a duller finish is desired in opaque or translucent films, small amounts of flattening agents can be incorporated.

MECHANICAL FACTORS. The most important mechanical factors in successful extrusion of vinyl film are listed as follows, starting from the back of the extruder:

(1) The removal of moisture from the compound is very important to prevent porosity in the film. Preheating of the compound will raise the capacity of the extruder to some extent.

(2) Control of stock temperature throughout the extruder must be very accurate and is achieved by controlling the heat input in zones, with the number of zones depending on the length of the barrel and output of the extruder.

(3) Because of the very considerable frictional heat developed, provisions must be made to dissipate this heat by adjustable cooling in sections.

(4) Internal cooling of the screw is of great importance when vinyls are being extruded and is best controlled by adjusting the water outlet temperature.

(5) The die must be designed to prevent deflection of the mandrel by the pressure of the stock and must be streamlined completely and very accurately machined in order to prevent stagnation of material insofar as possible.

Summary and Conclusions

Extrusion of rigid sheeting of all types and extrusion of polyethylene film are well established, rapidly expanding industries with a tremendous growth potential.

Extrusion of plasticized PVC film and sheeting is still largely a pioneering enterprise, but a few progressive processors have made it a successful production operation. Great interest in this field is being shown by some of the major raw material suppliers, testifying to the large potential in this field. All these factors should see this field of PVC film extrusion grow rapidly in the near future.

Meetings and Reports

First "Plastics in Building" Conference Attracts 500

The first "Plastics in Building" conference, consisting of an extensive program of addresses, discussions, and social events, was held at the Hall of Flags, U. S. Chamber of Commerce, Washington, D. C., October 27 and 28.

Conducted by the Building Research Institute of the National Academy of Sciences, National Research Council, and jointly sponsored by the Society of the Plastics Industry, Inc., the Building Research Advisory Board of the BRI, and the Manufacturing Chemists' Association, Inc., the conclave was attended by more than 500 architects, engineers, builders, manufacturers, researchers, and editors.

The format of the sessions covered an introduction to the general subject of plastics in building, specific applications, standards and codes, and future uses. Fifteen diverse papers were read, with floor discussions concluding each morning and afternoon session. The conference was brought to a close with a final summary presented by one representative each from the plastics and building industries.

H. N. Huntzicker, vice president in charge of research, U. S. Gypsum Co., was chairman of the conference. Moderators included Fred M. Hauserman, president of the Building Research Institute; Charles J. Romieux, American Cyanamid Co.; C. L. Crouch, Illuminating Engineering Society; Abner L. Roe, Wm. P. Lipscomb Co.; Ann Hatfield, Ann Hatfield Associates; C. Russell Mahaney, St. Regis Paper Co.; J. W. Kreuttner, Buensod-Stacey, Inc.; Paul E. Baseler, Building Officials Conference of America; and Robert W. McLaughlin, Princeton University.

Participants in the round-table discussion on the future of plastics in building were Max Abramovitz, Harrison & Abramovitz; Ray Foster Bover, Dow Chemical Co.; George Clark, Formica Co.; James Fitzgibbons, Geodesics, Inc.; Dahlen K. Ritchey, Mitchell & Ritchey; and Robert Fitch Smith, architect.

The major speakers and their topics, in chronological order, were as follows:

OCTOBER 27—MORNING

"Plastics Used in Building Con-

struction." E. B. Cooper, research division, polychemicals department, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Plastics differ significantly from other materials of construction in their reaction to applied loads, Mr. Cooper pointed out. When the load is removed, the displaced molecular segments slowly return to their original positions, thus allowing larger stresses than those suggested by measurements of elastic constants. He discussed the 16 commercially important types of plastics, cataloging them as to chemical type and modifiers added.

"Physical and Engineering Properties of Plastics." Albert G. H. Dietz, plastics research laboratory, Massachusetts Institute of Technology, Cambridge, Mass.

Plastics are in widespread use in buildings for waterproof adhesives, lacquers and varnishes, floor and wall coverings, illumination, and other applications, Mr. Dietz said. He discussed the chemical and engineering properties of the various building plastics, predicting their increased use, but cautioned that the history of these materials is too short for an accurate appraisal of their long-time behavior.

"Evaluating Plastics for Building Application." Tyler S. Rogers, Owens-Corning Fiberglas Corp., Toledo, O.

The usefulness of plastics in building is influenced by molding and fabricating methods and by economic factors, Mr. Rogers stated. He described the principal molding methods and reported comparative cost data. Physical limitations of plastics in building include elastic behavior or creep, lack of stiffness, high thermal expansion, limited resistance to temperatures above 300 to 500° F., and uncertain weathering characteristics, he said.

"Light-Transmitting Panels." John S. Berkson, Alsynite Co. of America, San Diego, Calif.

Glass-reinforced polyester building panels have been used as light transmitting media in commercial, industrial, and residential construction for more than seven years, Mr. Berkson said. These panels are easy to install, are almost shadowproof, have a high light diffusing factor, and permit the imaginative use of color and decorative effects. An interesting new development is their application to the manufacture of awnings, he added.

"Plastics for Glazing and Illumination." O. L. Pierson, Rohm & Haas Co., Bristol, Pa.

Acrylic dome skylights, acrylic and polyester glazing and prismatic panes, and vinyl and acrylic luminous ceilings were described by Dr. Pierson. The weathering limitations of vinyl plastic materials restrict their use to indoors, he explained.

OCTOBER 27—AFTERNOON

"Plastic Thermal Insulations and Vapor Seals." R. N. Kennedy, Dow Chemical Co., Midland, Mich.

Besides a low heat transmission rate (a K-factor of less than 0.50), thermal insulation should be durable, low cost, water and ice resistant, odorless, non-decaying and non-supporting of fungus growth, and strong in proportion to its weight, Mr. Kennedy said. Expanded plastics, such as polystyrene, meet these requirements.

"Plastics in Structural Panels." A. T. Waidelich, The Austin Co., Cleveland, O.

Most prefabricated plastic structural panels have been conceived as a sandwich with thin, strong exterior faces separated by a thicker, but lightweight core material, Mr. Waidelich stated. An all-plastic structural building frame is prohibitively expensive, compared to steel or concrete, and would suffer a loss of strength in moderately high temperatures he declared.

"Surfacing and Decorative Uses of Plastics in the Construction Field." Howard McCann, editor, *Modern Plastics*, New York, N. Y.

Mr. McCann covered the fields of vinyl flooring, decorative laminates of both high-pressure melamine and continuous polyester types, styrene wall tile, rigid vinyl copolymer laminate, and sprayed vinyls. He also reported his views of future developments in these fields.

OCTOBER 28—MORNING

"Plastic Piping." J. S. Whitaker, Bakelite Co., New York.

Plastic piping varies in effective tensile strength from about 600 psi. for polyethylene at 70° F. to about 6,000 psi. for combinations of glass fiber and thermosetting resins, Dr. Whitaker said. Other applicable materials include cellulose acetate butyrate, polyvinyl chloride, polyvinylidene chloride (Saran), and acrylonitrile copolymer blends, but polyethylene is the most widely used.

"Plastic Ducts and Conduits." Raymond B. Seymour, Atlas Mineral Products Co., Mertztown, Pa.

Dr. Seymour summarized the physical and chemical properties of polyethylene, polyfluorocarbons, polyvinyl chloride, and reinforced polyesters and stressed that they cannot be expected to replace all other types of material for duct work, but must be considered solely on the applicability of their properties.

"Standards for Plastics Products." Gordon M. Kline, National Bureau of Standards, Washington.

Plastics, like all other materials used by researchers, engineers, and manufacturers, must be subject to a universally accepted code of standards that would make for uniformity of product and facilitate the exchange of information, Dr. Kline asserted.

"Building Code Regulation of Plastic Building Materials." F. J. Rarig, Rohm & Haas Co., Philadelphia, Pa.

Presented by Mr. Rarig were possible ways of cutting down on the number of jurisdictions regulating building materials and of establishing uniformity of regulations and enforcement standards.

OCTOBER 28—AFTERNOON

"The Future of Plastics in Building." Johan A. Bjorksten, Bjorksten Research Laboratories, Inc., Madison, Wis.

Plastic film, used as anti-moisture stripping, will help overcome the public's prejudice against underground construction such as basements and habitable air-raid shelters, according to Dr. Bjorksten. He speculated that future increases in the world's population may necessitate the building of floating plastic houses for river, lake, and ocean habitation.

"Summary of the Conference." Robert K. Mueller, Monsanto Chemical Co., and H. N. Huntzicker, U. S. Gypsum Co., representing the plastics and building industries, respectively, concluded the conference by citing the enormous increase in plastics consumption during the past several years and optimistically viewing the future.

Vinyl Compound Wire Insulation with Cabflex DDP

Cabflex DDP (di-decyl phthalate) has been found valuable in the compounding of high-temperature wire vinyl insulation materials, according to Godfrey L. Cabot, Inc., 77 Franklin St., Boston 10, Mass., maker of the plasticizer.

The firm reports that Cabflex DDP has the lowest volatility of any primary monomeric ester which is commercially available as a vinyl resin plasticizer, lower than TCP (tri-cresyl phosphate), for many years the major plasticizer in 80° C. vinyl insulation compounds used by the wire and cable industry.

A high-temperature vinyl insulation compound, to meet Underwriters' Laboratory specifications, must retain a certain percentage of its original elongation after aging at an elevated temperature, a property dependent mainly on plasticizer volatility. Cabflex DDP, first introduced in 1952, fulfills this requirement, Cabot claims.

The advantages of Cabflex DDP over TCP, the company states, are lower cost, greater stability, absence of discoloration during processing, less yellowing, almost no tack after exposure to ultra-violet light, low-temperature characteristics equivalent to DOP, and lower water extraction.

Cabot reports the following formulation, Compound A-957[a], was developed:

Compound A-957[a]	Parts
Vinyl resin (electrical grade)	100
Cabflex DDP	38
TCP	20
#33 Clay	5
Dythal	6
Paraffin	0.5

Tests were conducted on #18 wire, 1/32-inch wall thickness, with an all-TCP commercially available 80° C. wire compound used as a control. Results were as follows:

	Cabot A-957[a]	Control (All TCP)
Insulation Resistance, Megohms, 1,000 feet, @		
15.6° C.	2580.00	3070.00
60.0° C.	7.80	0.23
75.0° C.	1.66	0.525
50.0° C.		
1 day	17.9	1.97
1 week	26.0	0.80
3 weeks	69.0	1.20
9 weeks	31.0	0.71
Low-Temperature Properties (Bent around 0.113-Inch Mandrel)		
Passed	−20° F.	−10° F.
Failed	−30° F.	−20° F.
Retention of Elongation		
7 days @ 113° C.	89%	83%

Crestfoam Offered

Flexible foamed vinyl and other plastic foam products for industrial applications have been introduced by Crest Chemical Industries, 72 Delavan St., Brooklyn 31, N. Y., under the name of Crestfoam. Open or closed cell structures are available in varying cell sizes, resiliencies, and densities ranging from 5-25 pounds per cubic foot.

Applications for the material include thermal and acoustical insulation, shock absorbing pads, packaging nests, non-stiffening sponges, molded gasketing, floats, footwear cushioning, and soles.

SPE Sections Report on Their Activities

SPE-ASME Joint Meeting and Exhibit

The November meeting of the New York Section of the Society of Plastics Engineers took the form of a joint meeting with the SPE Newark Section and the ASME Metropolitan Section, at Commercial High School, New York, N. Y., November 15. The meeting itself was a review forum which concluded the nine-week plastics symposium organized by the ASME Section in conjunction with the SPE groups; it featured a plastics exhibit sponsored by the New York Section. The exhibit consisted of displays by 36 plastic materials and processing companies to illustrate their products, operations, and fields of application. Arrangements for the exhibit were handled by William Lewi, Dusal Tool & Mold Co.

The forum, conducted by J. H. Du Bois, Mycalex Corp. of America, began with brief talks by the following speakers on subjects raised at previous sessions of the symposium; shell molds and other foundry applications for resins, George Rhine, *Plastics World;* isocyanate foams, George Sprague, Sponge Rubber Products Co.; plastics in orthopedic devices, Isaac Kinsey, Owens Corning Fiberglas Corp.; resorcinol resins, J. W. LaBelle, Foster Grant Co.; and plastic pipe markets and applications, H. J. Weber, Rotuba Extruders, Inc.

A spirited discussion followed as the meeting was thrown open to questions from the audience, which numbered more than 300 persons.

Dauphine Addresses Buffalo Section on "Hetron" Resins

T. C. Dauphine, manager of sales development, Hooker Electrochemical Co., Niagara Falls, N. Y., delivered a paper on Hooker "Hetron" resins before the Buffalo Section, SPE, October 15. Introduced in 1953, "Hetron" resins are unique polyester resins which possess outstanding fire and heat resistance combined with excellent strength and electrical properties, Dr. Dauphine reported.

These resins are different from other polyesters in that Het Acid, a stable chlorine containing dibasic acid, is incorporated into the molecular structure of the polyesters, Dr. Dauphine said. The resultant heavy molecule (MW 389) reacts smoothly with glycols and with maleic or fumaric acid to form an integral part of the polyester chain, and the chain may then be cross-linked through styrene or other cross-linking agents. The double bond in the ring is unreactive.

"Hetron's" physical and chemical properties, according to Dr. Dauphine, include tack-free curability in contact with air, resistance to acids, brine, and water over a wide temperature range, ability to be cross-linked with styrene, vinyl toluene, triallyl cyanurate, or diallyl phthalate, resistance to fire at no sacrifice of other properties, exhibition of very low loss factors over a wide range of electrical frequencies, and high flexural and tensile strength performance after cures as rapid as 1.5-3.0 minutes.

New England Section Holds Tenth Annual Meeting

The New England Section, SPE, held its tenth annual conference at Mt. Washington Hotel, Bretton Woods, N. H., October 12 and 13. In addition to six technical papers on various phases of the plastics industry, the program included a dramatic skit, slide-films, golf tournament, and a sightseeing trip.

John Walsh, Arthur D. Little, Inc., Cambridge, Mass., addressed the group on "Past, Present, and Potential Markets for Plastics," October 12. He traced the production rise of plastic materials in the past decade, estimating total production for 1953 at three billion pounds, or a value of $1.5 billion dollars. Estimated consumption of the major plastic materials in 1947 and 1953 and projected 1957 consumption were reported as shown in the table which is printed below.

(Millions of Pounds)

Resins	1947 Amount	1953 Amount	1953 % Growth over 1947	1957 Amount	1957 % Growth over 1953
Acrylics	30	80	165	120	50
Alkyds (molding)*	—	5	—	15	200
Cellulose esters	100	113	13	125	11
Ethyl cellulose	—	5	—	7	40
Epoxy resins	—	10	—	45	350
Fluorocarbons	—	4	—	10	150
Melamines	17	55	220	130	135
Petroleum resins	—	173	—	200	14
Phenolics	294	403	37	650	61
Polyesters	4	27	575	60	120
Polyethylene	15	120	700	500	320
Polystyrene	99	451	350	700	55
Silicones	—	5	—	15	200
Ureas	88	180	89	280	70
Vinyls	161	480	153	700	70
TOTAL		2,111		3,557	

*Alkyd resins, when used as a constituent of paints, are not included as a plastic. Consumption of these resins in paints approximates 360 million pounds a year.

Jules Pinsky, chief physicist, Plax Corp., West Hartford, Conn., delivered an address on "Some Practical Aspects of Polyethylene Permeability and Chemical Resistance," October 13. The talk was an appraisal of the effect of chemicals on polyethylene from the standpoint of both permeability and chemical and physical attack. A proper usage of data, Mr. Pinsky asserted, would allow for better-engineered utilization of polyethylene's properties.

"Balanced Gating for Injection Mold Design" was discussed by David A. Jones, product service department, plastics division, Celanese Corp. of America, Newark, N. J., October 13. To make it possible to calculate restricted gate sizes to be incorporated in a mold under construction, the following mathematical formula was suggested by Mr. Jones:

$$\text{Balanced Gate Value} = \frac{\text{(Cross Sectional Area of Gate)}}{\text{(Length of Runner to Gate)}^{1/2}\ \text{(Gate Land)}}$$

The resultant values effect a condition of balanced gating.

John I. Graham, superintendent of finishing, Worcester Moulded Plastics Co., Worcester, Mass., delivered a talk entitled, "Factors in the Decoration of Thermoplastics," October 13. Product design, mold design and construction, and molding, he said, were the primary challenges to the commercial finisher.

Edward McFaul, the principal speaker at the banquet held the evening of October 12, spoke on "How Confused Can You Get?" Chairman of the committee in charge of arrangements for the full session was Clifton J. Cowan, Cowan Boyden Corp., Providence, R. I.

Marketing Techniques Discussed at Philadelphia

Edward V. Hellyar, assistant sales manager of styrene molding materials, Monsanto Chemical Co., St. Louis, Mo., addressed the Philadelphia Section, SPE, meeting at the Franklin Institute, Philadelphia, Pa., October 26, on improved marketing techniques for plastic products.

Such improvements were necessary to maintain the astonishing growth of the plastics industry, now at a 1953 sales volume of more than 2½ billion pounds of material, he said, adding that it was the task of the marketing services to create sales and product ideas in conjunction with the new processes and materials.

Among the steps to be instituted or augmented, Mr. Hellyar listed providing technical services to customers, integrating advertising and sales promotional programs to create customer acceptance, showing public service films, encouraging the public to visit plants, broadening the use of statistical quality control, and making research programs a cooperative venture between manufacturer and fabricator.

South Texas Section Program on Melamines

John M. Girner, American Cyanamid Co., Dallas, Tex., gave an address on "The Melamine Resins" before the South Texas Section, SPE, meeting in Houston, Tex., October 20. The applications of these resins to the manufacture of adhesives, laminates, surface coating enamels, and molding compounds were specifically covered.

Melamine-based resins have bonding properties comparable to, and in some cases superior to, phenolics, Mr. Girner said. Modification with urea resins produces an adhesive which will pass the standard boil tests and will lower the overall cost of the resin so that it is competitive in price with other marine-grade plywood glues.

Hardness, abrasion and solvent resistance, and ability to form a transparent overlay also enable melamine resins to serve in a wide variety of industrial and decorative laminates, Mr. Girner continued. Surface coating in the form of baking enamels is another field that has benefited from the characteristics of these resins, he added.

When combined with suitable fillers, these resins form odorless, tasteless, and chemically inert molding compounds, he said. Such fillers include alpha-cellulose,

wood flour, chopped cotton cloth, asbestos, and glass.

Nemeth Addresses Newark Section On Fabrication

"Fabricated Plastics" was the subject of a talk presented by J. G. Nemeth, Insulating Fabricators, Inc., East Rutherford, N. J., before the Newark Section, SPE, meeting at the Military Park Hotel, Newark, N. J., November 10. The 150 members and guests also viewed a technicolor film, "The Polyester Resins," made at the California Zenith Plastics plant of Rohm & Haas Co.

Mr. Nemeth discussed the machining operations applicable to thermosetting and thermoplastic types of plastics, including shearing, punching, sawing, drilling, lathe turning, screw machining, milling, routing, shaping, engraving, marking, sanding, buffing, tumbling, post-forming, printing circuits, fungus proofing, annealing, and cementing.

The principal considerations determining the techniques of machining, he said, were reaction to heat, degree of abrasiveness, lowness of density, and relative homogeneity. Most plastics were shown to be heat insulators rather than conductors, abrasive enough to dull cutting tools, of low density compared to metals and thus permitting the use of lighter-duty machine tools, and, particularly the laminates, not homogeneous with different properties lengthwise and crosswise of sheet.

The Rohm & Haas film, centering on the use of polyester-fiberglass laminates in U. S. Air Force aircraft, pointed out that reduction of weight, high tensile strength, lower tool costs, and elimination of corrosion have placed these laminates on the top of the preferred material list for such military aircraft parts as tail assemblies and radar domes.

During the business session of the meeting, further information on the proposed certificate program of training in plastics engineering technology to be given at the Newark College of Engineering in conjunction with the Newark Section was announced. Two courses, one on compression molding, the other on injection molding, will be the initial offering for the January, 1955, term. Response to these two courses will serve as a guide to the instituting of a complete outline of courses. A complete course is tentatively planned for the September, 1955, term.

Table favors and door prizes for the meeting were donated by Thomas Mfg. Co., Newark, N. J., and Rohm & Haas Co.

Joint Meeting Hears Healey

A combined meeting of the Eastern New England Section, SPE, and the Boston-Providence Chapter, SPI, assembling at the Hotel Beaconfield, Brookline, Mass., October 21, heard an address by Joseph P. Healey, vice president in charge of sales, Manco Products, Inc., entitled, "An Evaluation of Beryllium Copper for Mold Components in Injection Molding."

Although copper is a soft metal, Mr. Healey pointed out, the addition of beryllium results in an alloy with a Rockwell hardness of 42 to 45 on the C scale, comparing favorably with steel which has a hardness in the low 50's. Many manufacturers, he said, have discovered that this more than meets the needs of certain high-quality injection molding.

Advantages of beryllium copper mold components were listed as follows: savings in time and money; no other way to make the cavities; excellent thermal conductivity; ease of replacing damaged components; lower maintenance costs; maintenance of dimensional tolerances; and especially appropriate application to first-rate tooling. Concluding, he stated that in most cases three molding cycles can be attained with a beryllium copper mold; whereas for the same time interval the steel counterpart averages only two.

During the business session of the meeting Ralph Mondano discussed "Plastics Education" and suggested that the group consider the possibility of a lecture series. A door prize, a plastic wading pool, was won by Richard Bishop, of Foster-Grant.

Miami Valley Section Tours

Seventy-five members of the Miami Valley Section, SPE, were conducted on a tour of Cincinnati Milling Machine Co., Cincinnati, O., November 11. In addition to surveying the company's facilities and manufacturing techniques, the group viewed special demonstrations, including three-dimensional duplicators at work on mold cavities, and the sheet metal drawing operation known as the "Hydro-form" process.

Business transacted at the meeting included the naming of new directors for the Section. These were: Ray Adams, Adams Plastics; Paul Caldwell, Plastic Research Products; and Martin Kasch, Kurz-Kasch, Inc. Retiring directors were Richard Bice, Formica Corp., and Joe Merke, Plastic Moldings Corp.

Cleveland-Akron Hears Richardson

The Cleveland-Akron Section meeting at Brecksville, O., November 8, was addressed by L. D. Richardson, Eutectic Welding Alloys Co., Cleveland, O., on "Maintenance and Repair of Plastics Tools by Welding." The uses of welding to repair dies and molds, including the techniques and types of welding rod for application on various metals, were covered by Mr. Richardson. Seventy-five members were present.

Safety Committee for Plastics Industry

At the initial meeting of the newly formed safety committee of The Society of the Plastics Industry, Inc., New York, N. Y., it was decided to develop a safety manual for plastics processors. The material in this manual will serve to acquaint officials with what does and does not constitute a fire hazard and will contain do's and don't's regarding plant operation. Work on the publication will be done in close cooperation with the National Board of Fire Underwriters and the National Safety Council.

Everett W. Bickford, manager of employe and plant community relations, plastics department, General Electric Co., Pittsfield, Mass., was named general chairman of the safety committee. Since the activities of this group cover a large number of companies, subcommittee chairmen were named to represent the different branches of the plastics industry.

For Injection Molding, Donald Fegley, chief engineer, Consolidated Molded Products Corp., Scranton, Pa.; Compression Molding and Preforming, A. E. Campi, plant manager, International Molded Plastics, Inc., Cleveland, O.; Extruding, Alfred Bischoff, safety engineer, Celanese Corp. of America, Newark, N. J.; Laminating, R. R. Johnson, safety director, Richardson Co., Melrose Park, Ill.; Health, Hygiene, and Dust Control, A. G. Cranch, medical consultant, Bakelite Co., Union Carbide & Carbon Corp., New York; Decorating, Finishing, and Inspecting, F. W. Munson, personnel manager, G. Felsenthal & Sons, Inc., Chicago, Ill.; Fire Control and Raw Material Storage, Charles Rybolt, sales manager, Lucidol division, Wallace & Tiernan, Inc., Buffalo, N. Y.; Maintenance and Power Supply Personnel, Stanley A. Wright, supervisor, safety and housekeeping department, Inland Mfg. Division, General Motors Corp., Dayton, O.; and Materials Handling, Harold Lenheiser, chief engineer, Wolverine Plastics, Inc., Milan, Mich.

Midget Darrins

Junior-size models of the Kaiser Darrin 161 sports car, formed from rigid Seilon plastic manufactured by Seiberling Rubber Co., Akron, O., were recently employed by Kaiser in a sales promotion program in California and Hawaii. The miniature cars, accurate one-third scale models, were complete with safety foot-brakes.

Junior Size Sports Car Made of Seilon PVC

Scientific and Technical Activities

Chicago Rubber Group Symposium on Butyl Rubber

Five speakers participated in a symposium entitled "The Butyl Story," sponsored by the Chicago Rubber Group, at the Furniture Club, Chicago, Ill., November 5. These were W. H. Peterson, Enjay Co., Inc.; L. C. Peterson, United States Rubber Co.; K. W. Stevens, Yale Rubber Mfg. Co.; B. J. Ferkes, Firestone Industrial Products; and C. F. Hoover, Pequanoc Rubber Co. Moderator of the session, attended by 210 members, was William Simpson, Chrysler Corp. A question-and-answer period terminated the evening's activities.

Butyl Production and Processing

Constituting an introduction to the subject, W. H. Peterson's paper covered the production and the processing of the basic Butyl rubber from the interaction of the isobutylene and isoprene raw materials to the packaging of the finished product in plastic film. Six grades, representing four different cure rates and three different states of plasticity, are produced in the government owned plants.

These Butyl grades all contain a staining antioxidant which limits their use to those applications where staining and discoloration are not factors, he said. Consequently private producers were seeking specific antioxidants that would result in a non-staining and non-discoloring Butyl for future manufacture. Also being sought were means of improving the Butyl vulcanizate to the same degree by chemical means when both black and mineral pigments are added in conventional mixing techniques, as is obtained now by thermal interaction of Butyl with carbon black.

The Butyl Tube Story

The Butyl story to date is largely the Butyl tube story, L. C. Peterson said. Since the first Butyl tube was made in Indianapolis in January, 1942, we have seen the Butyl tube achieve such acceptance that return to tubes of natural rubber is almost inconceivable. For many years before the advent of Butyl we were seriously concerned with these problems: (1) how to make an inner tube that holds air better; (2) how to make an inner tube that resists heat better; (3) how to improve tear resistance, particularly after some service. The first two reflected a definite service need, and we were limited by the properties of natural rubber as we knew them.

Butyl tubes hold air many times (perhaps 10 to 12 times) better than natural rubber. Rubber tubes are heat aged to extinction by severe service long before Butyl tubes show much evidence of deterioration. Tear resistance of Butyl is better and more lasting than natural rubber.

Field experience with the early Butyl tubes showed only one major deficiency which results from a tendency to stiffen at temperatures of —10° F. and lower. Under circumstances of low inflation pressure and extreme cold, Butyl tubes are unable to recover as fast as the rolling casing in which they are mounted. This disadvantage causes progressive formation of wrinkles, or what we call cold buckles, in the tube which, if extensive enough, can rub together within the air cavity to result in failure.

A great deal has been done to overcome this dificiency of Butyl, such as the use of substantial proportions of mineral oil in the compound; high temperature cures; and proper choice of black in the tube stock. The demonstrated benefit of using relatively large quantities of oil in Butyl to improve cold weather resistance resulted in the quite general move to the high-viscosity Butyl polymers GR-I 17 and GR-I 18. Today it is common to use as much as 25 parts of oil for 100 parts of polymer and to use curing temperatures as high as 360° F.

Only in a few districts in our northern tier of states are natural rubber tubes still demanded by the consumer. When it is realized that temperatures as low as —47° are not infrequent in Great Falls, Mont., and that Duluth, Minn., has as many as 27 days with temperatures of —10° during the three months—December, January, and February—it is possible that under certain conditions Butyl tubes might not be completely adequate.

Butyl does not react to factory processing in the same manner as natural rubber. There is a tendency to bruising such as results from sharp creasing of extruded sections. If such a piece of rubber is stretched, thinning results at the crease or fold. A similar weakness occurs when Butyl sections are joined, and it is common practice to chill splices before forming just ahead of the molding process. While uncured Butyl stocks, particularly when warm, appear tacky, uncured bonds are weak owing to the lack of strength of the material itself. Momentary pressure applications, such as used for joining uncured natural rubber stocks, are usually insufficient for Butyl. Ordinary stitching or rolling does not produce laps or seams good enough to allow safe handling of assemblies. Application of sustained pressures for appreciable periods of time seems necessary for most assembly operations, i.e., a certain amount of dwell time, up to four or five seconds, is required.

If it had been necessary to bond some material other than cured Butyl rubber to the uncured Butyl tube sections, progress of the Butyl tube might have been delayed. The quality of Butyl valves has been excellent, and even for some natural rubber tube applications, Butyl rubber valves have been used. It is easy to adhere cured Butyl rubber by the use of ordinary rubber cements to uncured natural rubber where it is not possible to adhere cured natural rubber valves to uncured Butyl by any such means.

The most serious initial and continuing manufacturing problem has been that of segregating Butyl from all other polymers that may be used in the same mill room or manufacturing departments. Butyl compounds in portions as low as 1% are serious contaminants for natural rubber and GR-S. Results of such contamination are cure rate irregularities, blistered cures, and low physical properties. Production experience has resulted in segregation of compounds by the use of such devices as colored stripes, colored liners, and identification of scrap containers and the like. Segregation of mixing equipment for the use of Butyl is required. Such equipment, if it must be used for non-Butyl stocks, must be cleaned by the use of clean-up batches which are eventually discarded. Production changeover from Butyl to another type of rubber should be planned and scheduled with clean-up operations and reliable inspection.

Mechanical Rubber Goods

Discussing "Butyl Rubber Mechanical Goods," K. W. Stevens noted that such applications are still matters of controversy. On the positive side he listed the advantages of the material, including high gum tensile strength, excellent release and finish from molds, high elongation and low modulus when desired, savings in compounding cost because antioxidants and protective waxes are not normally required, good Banbury mixing, and high processing safety.

Comparing Butyl with other rubbers, Stevens mentioned that zinc stearate is a better slab dusting agent than soapstone or talc in preventing sticking to warming mills. He also pointed out that although Butyl stocks extrude from two-thirds to three-quarters slower than similar GR-S and natural rubber stocks, roughness of the extrusion can be mitigated by the use of extended tuber heads and long, gradual leads on tuber dies.

This speaker admitted that Butyl compounds, curing slowly, require larger additions of expensive accelerators. Another disadvantage, the tendency of parts to blister in molding operations, can be overcome by aging the mold preparation for at least 24 hours and by proper mold design, including venting, he said.

Butyl Reclaim

C. F. Hoover, discussing "Butyl Reclaim," asserted that the physical properties of this reclaim more nearly approach the properties of the basic mix than those from any other elastomer. The inherent nature of Butyl, principally its degree of saturation and limitations with respect to curatives, prove of great advantage to the reclaimer, he said.

Describing a common method of reclaiming Butyl tire tubes, he explained that first the valves are removed, the tubes cracked on a conventional heavy-duty corrugated mill, and the sized stock placed into pans with suitable oils and heat treated for proper plasticization. Banding on a mill, rough refining, straining, and finishing follow. The refined reclaim is smooth, has a fine texture, and possesses excellent uncured elastic properties. Finally, a blue mark or stripe is painted on to identify the product as reclaimed Butyl.

Tube manufacturers customarily use 10-20% of the weight of their compound as Butyl reclaim, Mr. Hoover said. Another application is for hose, where extrusion, aging, and price are of major importance. Other uses include addition to mechanically blown sponges, compounds to insure a firm outer skin, and in tacky natural and GR-S calendering compounds to assist in mill and calender release at elevated temperatures.

Testing of the tensile strength and elongation qualities of Butyl reclaim is generally run with the Rubber Reclaimers

Association compound on a range of press cures at 320° F. and at intervals of 15, 20, and 30 minutes, according to Mr. Hoover. Data derived at this temperature show tensile values of 1500-1600 psi. and elongations of 500-550%. Also obtained are Mooney viscosity readings of 55-70 at 212° F., durometer readings of 42-50, and specific gravities of 1.14-1.17.

Chemical characteristics, determined by standard ASTM methods, indicate acetone extracts in the range of 5-8%, with 6-10% ash, 27-30% carbon black, and 54-58% Butyl rubber hydrocarbon. He estimated the annual tonnage of discarded inner tubes at up to 25,000, insuring adequate raw material for Butyl reclaiming.

Industrial Rubber Products

B. J. Ferkes, in his talk on "Butyl Industrial Rubber Products," named such applications for the material as weather strips, gaskets, seals, steam and automotive radiator hose, tank linings, flotation gear, and vibration dampeners. These function well because of such Butyl qualities as weather, steam, water, heat, and ozone resistance, high hysteresis characteristic, and resistance to strong mineral acids and alkalies, he said.

Another of Butyl's advantages, Ferkes continued, is its good knitting and flow properties, coupled with excellent hot tear strength, which make for efficient molding of intricate parts or those difficult to remove from the mold, such as corrugated boots or channel strips.

Finally, Ferkes asserted that in the matter of colored goods, particularly in the automotive industry, Butyl can compete successfully against natural rubber and other synthetics because of superior age resistance and lower costs. Sulfur bloom, previously a problem in colored stocks, can be eliminated by using Sulfasan R[1] (dithiodimorpholine), a mixture of elemental sulfur and an organic sulfide.

Also, because of excellent damping properties Butyl may soon be used for certain-type motor mounts as the adhesion to metal techniques are improved.

Questions and Answers

Following are the questions asked of the guest speakers and their answers:

Q. What are the present status and future possibilities of Butyl reclaim?

A. Hoover. Satisfactory Butyl reclaims of various grades are on the market. Future possibilities are excellent.

Q. Is there a non-staining Butyl rubber available?

A. W. H. Peterson. There is no such Butyl available in this country, but there is in Canada. If Enjay Co. purchases the government facilities for making Butyl, a non-staining polymer will be produced.

Q. Can a Butyl film be calendered free of blisters?

A. Hoover. The use of Butyl reclaim helps.

A. W. H. Peterson. We recommend hot calendering. The hotter the mix the more dense the stock and the fewer the blisters.

Q. If tubeless tires replace inner tubes, what are the probable outlets for the Butyl now being used in tubes?

A. Ferkes. Many miscellaneous mechanical goods can be made with Butyl, especially colored automotive products such as radiator hose. Products where low hysteresis is important will also use Butyl.

A. Stevens. The automotive uses are almost unlimited. The only places where Butyl cannot be used is where a high strength bond to metal is necessary. One car manufacturer already is using twice the poundage of Butyl per car for miscellaneous parts as is used in the inner tubes of the car.

Q. Can Butyl be made with a non-tacky surface?

A. Stevens. Calcium stearate or paraffin in the compound may help.

Q. What is the relative difference in heat build-up between Butyl and natural rubber stocks in comparative black loading?

A. W. H. Peterson. Butyl rubber thermally reacted with carbon black has less heat build-up.

Q. Is Butyl reclaim compatible with other elastomers?

A. Hoover. Small amounts can be used with other elastomers. A 50-50 mix of whole tire reclaim and Butyl tube reclaim can be used, but the tensile is that of the lowest component.

Q. What is the future of Butyl in tires?

A. L. C. Peterson. There is a big future especially in farm tires where good aging is important.

Q. Is Butyl compatible with GR-S, with or without the use of a third component?

A. L. C. Peterson. No.

Q. What can the rubber manufacturer expect in uniformity of Butyl reclaims?

A. Hoover. Uniformity is excellent. It is based on adequate selection and segregation procedures and on testing of every batch of finished reclaim by the producer.

Q. What are the practical limits for functional low-temperature flexibility?

A. W. H. Peterson. Butyl gets stiff, but not brittle. Inner tubes are an example of functional use at low temperature. The U. S. Army is at present making tests at —65° F. Thermally interacted batches of Butyl are flexible at lower temperatures than regular Butyl. Conventional low-temperature plasticizers such as adipates, azelates, and TOF are useful with Butyl.

Q. How can one tell when Butyl is contaminated with rubber or GR-S or *vice versa?*

A. L. C. Peterson. Contamination usually produces layering or blistering during cure. Positive identification is obtained by placing the stock in nitric acid. With small amounts of natural rubber or GR-S the stock turns black at once.

Q. What compounding ingredient is most needed in Butyl compounding?

A. Stevens. An ingredient which would help maintain the shape of uncured compounds. At present, slabs tend to run off the skids, and tubing buckles and tends to sag out of shape.

A. Ferkes. An ingredient to improve the resilience of colored Butyl compounds.

Q. How uniform is Butyl in cure rate and viscosity?

A. L. C. Peterson. Butyl is quite uniform in each respect at the present time. Great strides in improvement have been made. The scorch test, as run according to "Government Specifications for Synthetic Rubbers," has helped greatly.

Q. What is a good release agent for clay-loaded compounds?

A. Stevens. Calcium stearate in the compound or a silicone emulsion on the mold is reported to be helpful.

Q. Can oil resistance of Butyl be increased?

A. Ferkes. Increased loading may help, but oil resistance will not be improved much.

Q. What type of resins and processing oils are recommended for softeners and plasticizers?

A. Ferkes. Almost any conventional softener or plasticizer may be used if it is not too high in unsaturation.

A. L. C. Peterson. Usual softeners are mineral oils of the paraffinic or naphthenic type.

Q. What are the staining characteristics of Butyl reclaim?

A. Hoover. They are similar to those of the original polymer from which the reclaim is made. When non-staining Butyl is made, non-staining reclaim will be made.

Q. Can you heat-treat Butyl alone?

A. W. H. Peterson. Heat-treating is done in the presence of pigments now. Later we hope to work out a method for heat-treating the rubber only.

Q. Does the thermal interaction of Butyl and carbon black give better abrasion resistance?

A. W. H. Peterson. Yes. Abrasion resistance is better in lab tests and in road tests of tires.

Q. What is the minimum temperature for thermal interaction of Butyl with carbon black?

A. W. H. Peterson. The reaction depends on time and temperature. In a short Banbury cycle it is necessary to use 400 to 450° F., but in an autoclave 320° F. may be used. Work is continuing on this feature of the use of Butyl.

Research Emphasis on Stronger Plastics and Rubbers

A. M. Borders, associate director, central research department, Minnesota Mining & Mfg. Co., St. Paul, Minn., addressed the annual meeting of the Elastomer & Plastics Group, Northeastern Section, American Chemical Society, held October 19 at Massachusetts Institute of Technology, Cambridge, Mass., with 70 members and guests in attendance. His topic was "Trends in Rubber and Plastic Research."

As evidence of the industry-wide search for stronger plastic materials, Dr. Borders cited his company's development of Scotchply, a semi-cured plastic reinforced with glass fibers and available as unidirectional or isotropic laminates, as well as in polyester and epoxy formulations. Very strong, drawn shapes are possible with this material, he stated, and the products can be handled like sheet metal.

In the rubber field, future developments will see new materials of lower hysteresis and of high gum quality filling present gaps in available materials, he asserted. For really high temperatures, inorganic polymers will most likely be better sources of resistant materials than organic polymers, he added.

Other topics covered were fluorine elastomers of increasing fluorine content, including Poly FBA, and the effects of high-energy radiation on plastics and rubbers, particularly polyethylene. The speaker also foresaw financial support being supplied by the Federal Government for elastomer research, especially in the military rubber field where commercial outlets were limited.

Chairman of the Group for the coming year is Frank J. Roderick, Simplex Wire & Cable Co. Other officers elected for 1955 are: Charles S. Frary, Jr., Boston Woven Hose & Rubber Co., chairman-elect; Mrs. Clara W. Gnerre, Godfrey L. Cabot Co. Laboratories, secretary-treasurer; Max Taitel, Union Bay State Chemical Co., custodian; and Henry A. Hill, National Polychemicals, Inc., executive committee member.

[1]Monsanto Chemical Co., Rubber Chemicals Department, Akron, O.

Philadelphia Group Extrusion Panel Meeting Well Attended

The panel discussion meeting on extrusion held by the Philadelphia Rubber Group at the Poor Richard Club, Philadelphia, Pa., November 12, attracted a record attendance of 175 members and guests. At the technical meeting in the afternoon and the evening dinner meeting, Group Chairman A. J. DiMaggio, Firestone Tire & Rubber Co., presided. Program Chairman M. A. Youker, E. I. du Pont de Nemours & Co., Inc., introduced the panel members and acted as moderator for the afternoon panel discussion.

At the evening dinner meeting, Chairman DiMaggio reported that the Group's rubber technology course would be conducted at Villanova College and would begin during the second college semester (early 1955). More than 100 members have indicated an interest in the proposed course.

The Extrusion Panel

The four-member panel consisted of the following men: V. M. Hovey, John Royle & Sons; Alvin Gray, Western Electric Co.; Paul Hopkins, Electric Hose & Rubber Co.; and Charles Glaser, Lee Rubber & Tire Corp.

In addition to answering some of the questions directed at the panel, Mr. Hovey gave an introductory talk, which he illustrated with slides and entitled "The Evolution of the Rubber Extruder." Most of the historical data in this talk were taken from the John Royle & Sons publication, "Onward from the Beginning."

"The Rubber Extruder"

Mr. Hovey began his talk by stating that it was some 20 years after John and Vernon Royle, father and son, made the first 3¼-inch commercial rubber extruder in 1880, before anyone from the Royle machine shop was able to get into a rubber plant to see one of their extruders work.

During this span of years the rubber extruder was improved with regard to thrust section, reduction gears, and parts standardization. Many of the features of the original 1880 Royle machines are still in use today. These include the worm gear drive, cylinder cored for steam and water circulation, multiple-thread screws, and jacketed head. Cylinders that may be rebushed, and the three-point clutch bonnet were introduced in 1895 and are still standard on Royle extruders.

The first six-inch tuber for the tire industry was made in 1900. The first straining plates were made for extruders in 1902. Screens were not used at first; the straining plates were drilled with 1/16-inch diameter holes, of which there were 1,600 for the plate for the No. 4 machine. Three-way straining heads were introduced in 1913 and sleeve-type cylindrical heads were common until the gate-type expansion head was patented in 1929.

Mr. Hovey said that it was interesting to note that neoprene is being strained without much heat build-up at the present time with the old sleeve-type strainer in one of the eastern wire insulating plants.

The evolution of thrust bearings for extruders began with the "lathe center" friction bearing in the 1880 machine. This hard-to-lubricate bearing was followed by alternate steel and bronze friction washers, ball bearings, and a Royle-made tapered roller bearing.

The multi-step marine-type bearing was introduced in 1894, and nearly all of the Royle Perfected line of extruders used this bearing until more refined ball-bearing assemblies were made available in 1924. In 1928 roller bearings were again put in use and are still being used today. Bearing ratings on a given machine have tripled in the last 20 years, it was said.

Motor horsepower requirements have more than quadrupled in the last 50 years. The following table will show this change.

INCREASE IN RUBBER EXTRUDER H.P. REQUIREMENTS

	H. P. Required		
Royle Tuber Size No.	1907	1932	1954
2 (3¼-in.)	5	10-15	25-30
3 (4½-in.)	7½	20-30	40-60
4 (6-in.)	10	40-50	60-75

The demand for tougher rubber stocks and higher throughput resulted in a change to cast-steel cylinder and head construction in 1947-48. The steel cylinders are about 90% stronger than the cast-iron members, and repairs and relining are simpler and less expensive with the new construction.

In conclusion, Mr. Hovey said that with the new synthetic rubbers and the room temperature extrusion process requiring the extension of the length of extruder barrels, it is apparent that the differences between rubber and plastics extrusion will become less and less.

The Questions and Answers

Screw Design

Q. For all-around quality and production performance what type of screw should be used?

A. Hovey. If the various rubbers and elastomers are fed hot, then the old double-flight, decreasing lead, rubber screw of the 1890's is hard to beat. Lengthening of this screw to an L/D of 10 to 11 seems to improve uniformity of extrusion. If the stock is fed cold, perhaps a modified screw of much the same lead characteristics as the old rubber screw with a tapered root diameter is the answer. The choking of the screw will provide the extra work on the stock to provide the temperature rise necessary for proper extrusion conditions.

Q. Is there a type of screw designed to extrude rubber and plastics (both dry blend and granular polyvinyl chloride type); and if so, can maximum output be expected with the different types of material?

A. Gray. No. I have been ambitious for several years to approach part of the objective indicated in this question, but as yet I have not been able to resolve the matter. I believe that the line of work we are following may finally result in a development that will be applicable to both elastomers and plastics with a fair degree of efficiency on all, but we do not hope to obtain maximum output for all types of materials.

A. Hopkins. I do not know of any screw designed that will extrude both rubber and PVC in a suitable manner.

The extrusion of PVC requires a longer screw with higher compression ratios which would cause rubber stocks to scorch from the larger amount of heat generated along the screw. Conversely, screws designed for rubber compounds do not develop sufficient pressure and temperature properly to flux and fuse PVC.

In extruding a rubber compound it is only desired to shape the article, adding as little heat history as possible; therefore the shorter cylinder and screw are best. The extrusion of PVC requires the addition of heat obtained from mechanical working of the material and supplied from other sources through the cylinder wall in order to plasticize this-type compound. The temperature of the cylinder or heating surface must not be too high, or local overheating resulting in decomposition of the vinyl compound will occur. Sufficient heating surface area to transfer the required BTU's at the established temperature differentials to plasticize a given amount of material must be provided, that is, a longer cylinder for PVC compounds.

Q. Have you had any experience with the reduction of screw dimension in the hopper section?

A. Hovey. Yes. At one time it was considered rather essential, and it was one of the reasons why screws were not hard surfaced in the exposed throat section of the machine. Various operators had their own ideas how much to reduce the screw diameter in the hopper. Carefully designed undercutting in the hopper, however, has eliminated the necessity of this practice.

Hopper Design

Q. Can oversizing the hopper lead to any kind of trouble?

A. Hovey. If the hopper is longer than the screw lead, regurgitation of the rubber is inevitable. The hopper opening parallel to the screw is usually one or two inches longer than the screw diameter. For plastics extrusion it has been proposed that the hopper length should not exceed the diameter for best feeding conditions.

Q. What is the value of undercutting the barrel at the hopper, and how far can it be carried out?

A. Hovey. A review of Royle patents of 1880, 1883, 1924, and 1930 shows the evolution of hopper construction from a direct on-top-no-undercut feed to the deep tangential undercut of today. The limiting factor in undercutting is the ability of the screw to clean the bore and leave no tailings. In the old cast-iron cylinders the clearance in the undercut gradually became too great through long service for good feeding. In the new cast-steel hoppers a reweld job and reshaping can restore the unit to its initial performance characteristics with little cost or time involved.

Stock Feeding

Q. Is it possible to feed pellets into an extruder and get uniform extrusion?

A. Gray. Yes. Whether the material is in the form of pellets or strip is unimportant so long as care is exercised to see that the same amount of material is bitten off by the screw at each rotation. Variable extrusion will result unless this uniform bite is provided for.

Q. What amount of excess stock should be kept in the hopper, that is, the amount of rolling ball or bank?

A. Hopkins. With hand-feeding, as practised in many mechanical rubber goods plants, a large percentage of size variations and porosity of extrusions are caused directly by faulty feeding of the stock. The general tendency by operators is to "starve" the screw. An extruder screw for efficient and uniform operation should be fed continuously up to the choke point, which procedure will produce a rolling bank with most compounds. Where the feed hopper is small, the rolling bank should not be

allowed to become so large that it backs up in the hopper and forms a bridge over the screw.

A. Gray. The rolling ball or bank maintained in a hopper should be such that when the screw rotates to take a bite, no vacant space is allowed in the flight of the screw. The screw should get a full bite at each rotation.

Q. What is the thinking on use of non-curing head stock for shutdowns? What kind and how hard a compound should be used?

A. Glaser. Where smoked sheet rubber is available, there is little, if any, need of special non-curing stock. The smoked sheet rubber has sufficient resistance to push the stock ahead of it at the end of the run and, in turn, is easily removed by the stock at the beginning of the next run.

Smoked sheet rubber is better than GR-S for cleanout work. After the rubber has been used for this purpose, it can be checked on a mill; any lumps of cured stock picked up can be removed, and the rubber may then be used in a workaway compound.

A. Hopkins. The procedure of leaving highly plasticized stock in the extruder during brief shutdown periods did not prove so economical as a complete cleanout with us, all factors considered. It is sometimes the practice to leave normal hose cover compounds in cross-head extruders over brief shutdown periods; the only precaution is to turn off all water and/or steam to the machine. The heat remaining in the compound will hold over, and the extruder may be started again with being overloaded. Only highly plasticized compounds with delayed curing characteristics should be used when this practice is followed. If the stock in the extruder is allowed to cool down during the shutdown, overload and damage to the equipment is likely at the start-up.

Q. When is the aging of stock prior to extrusion necessary? What are the advantages of such aging?

A. Hopkins. Neoprene, nitrile type, and Thiokol compounds, and compounds containing plasticizers whose action continues for some time after mixing, extrude more satisfactorily if aged at least 24 hours before use. It is desirable to age all compounded stocks a predetermined time to eliminate plasticity variables which do occur with most compounds in storage, but in the average mechanical goods plant such a procedure is not always feasible.

A. Gray. In my experience I never encountered a compound which showed any advantage whatever due to aging of the stock before extrusion. If the stock is properly mixed, it is ready to be extruded as soon as mixed. Otherwise I suspect the stock was not mixed properly.

Control of Temperature, Porosity, Etc.

Q. What are the best ways to control extrusion temperature? What extrusion equipment operation changes affect temperature?

A. Gray. To answer the second question first, the principal effect on extrusion temperature is exerted by the rotation of the screw. All the power that goes into the rotation of the screw is converted to heat, most of which is absorbed by the plastic being extruded. The other influences are externally introduced heat from electrical heaters or circulating fluids.

The best way to control extrusion temperature is to make sure that the screw is never rotated even one RPM faster than is essential to push out the material being extruded. It is, I think, unfortunate that variable screw speeds are so often used blindly to speed up extrusion without reference to the deleterious effects of the excessive working of the material in the machine.

Q. What are the causes and methods for control of porosity and blistering of extruded stock?

A. Hopkins. Basically any combination of equipment design and/or formulation which will produce a lower extrusion temperature will increase stock density and result in reduced porosity.

Considering the extruder only, any equipment combination that will increase output of the screw per RPM will lower extrusion temperature proportionately. Other factors which affect the output are: (1) the design of the feed hopper, which should be of ample proportions and well undercut; (2) the clearance of the screw, which should not be excessive as this condition generates additional heat; (3) insufficient cooling water, either in volume or not low enough in temperature. The screw should be drilled to permit circulation of cooling water clear to the nose of the screw. The spider and dies should be designed to give "streamlined" flow within the confines of good sense.

Considering the operator, proper feeding is of great importance. Starving the extruder is one of the most common causes of porosity, particularly when this-type feeding occurs intermittently during a run.

Much can be accomplished in compounding by adjusting the formulation to improve stock density while retaining the desired finished product properties. The formulation which will give the maximum extrusion capacity with the lowest possible temperature will result in denser extrusion and greater freedom from blisters.

A. Gray. I believe the three major causes of blistering in extrusion are: (1) nonsolid cores which contain expandible gases or volatile liquids; (2) volatile liquids present on solid cores; (3) gases or volatile liquids incorporated in the compound.

In most machines in existence today, particularly those extruding prewarmed compound, the screw theads are deep, and whether air is entrapped in the compound during the mixing process, which condition is inevitable, or whether it is trapped into the compound as it is being fed into the extrusion screw, there is not sufficient throttling of the compound in the conventional screw to force the gas back out of the feed throat. Consequently it follows through and is highly compressed, and as soon as it emerges from the high pressure, the gas or air expands, causing blisters.

Extrusion of Various Rubbers

Q. Compare the basic extrusion characteristics of the different GR-S polymers, e.g., hot, cold, and oil-extended.

A. Glaser. So many of the differences in extrusion characteristics which would be found, if each of the GR-S types mentioned were substituted in an otherwise constant formula, can be greatly modified or even eliminated by changing ingredients in the formula that it is difficult to say which characteristics are basic and which are not. The relation of die opening to dimensions of the extruded piece seems to be the most difficult to modify, however, and therefore may be considered basic.

Using tread-type stocks as an example, a die opening of approximately 0.085-inch gave an extruded thickness of 0.100-inch with LTP GR-S. To achieve this same thickness with the oil-extended polymer, the opening would be about 0.045-inch, and with hot GR-S might be as low as 0.033-inch. On the other hand, to cite a case where rather extreme compound changes could be tolerated, an oil-extended polymer stock could be run through the same dies as a GR-S 1500 (LTP) stock to almost the same finished dimensions.

Extrusion speed can be modified by mechanical working, the use of peptizers, and addition of plasticizers, but if all of these are held constant, the order of decreasing speed would be (1) hot, (2) cold, and (3) oil-extended polymer.

While the ability to extrude to a feather edge or intricate profile can also be modified over a wide range by compound changes, LTP GR-S stocks should be better for this purpose because they usually have the smoothest and most even surfaces. Hot GR-S stocks generally appear glossy, but have an uneven surface; while oil-extended polymer stocks are dull and grainy.

Q. How can the tendency of oil-extended LTP stocks to shrink be reduced?

A. Glaser. The following three means are effective in reducing the shrinkage of oil-extended LTP stocks: (1) Maintain temperature during mechanical breakdown below that of gel formation. (300° F. appears safe; loose gel in evidence at 350° F.; tight gel at 390° F.) (2) Use peptizers such as the RPA's[1] and Pepton 22.[2] (3) Use strong plasticizers such as Reogen.[3]

The above means may be used individually or in various combinations, depending on the degree of shrinkage to be overcome.

Q. Why do other polymers extrude better than neoprene?

A. Gray. They don't. Neoprene, if carefully handled, can be worked down to the point where it could be squeezed through the nozzle of a household cake decorating device. I know of no elastomer which is more amenable to breakdown and easy extrusion than is neoprene, provided the material is not maltreated in the mixing operation.

Q. What are the optimum screw characteristics for the extrusion of Butyl and silicone rubbers?

A. Hovey. For either rubber the best screw is one that will pull the material into the throat of the machine with the least tearing and the most "grab." I have seen a well-worn, loose-fitting, constant-depth plastic screw doing a good job with silicone rubber. The best new screw for extruding silicone rubber, however, has about the same characteristics as the common strainer screw, that is, single flight, deep, and with little compression.

Extended deep screws work best for Butyl rubber. Hopper undercut of the right design is a necessity. Roller feeds are used by some to advantage. Threading the top of the land in the exposed throat section with a common machine thread, six per inch, definitely helps the slippery stocks to feed better. The thread advances in the same direction as the screw flight.

Process Control

Q. What methods are used to control shrinkage and swell at extrusion? What effect does the design of the die have, such as length of die proper, and the angle or contour of the inner slope, on the rate of extrusion, smoothness and swelling characteristics, etc.?

A. Hopkins. Answering the second part of this question first, the design of the tube die, particularly its length, is most significant to the operation of the machine.

[1] Du Pont rubber chemicals department.
[2] American Cyanamid Co., New York, N. Y.
[3] R. T. Vanderbilt Co., New York.

The following recommendations apply to the die head as well as the die proper: (1) Keep the die as close as possible to the end of the screw, and a better job of extrusion will result. In general, the die should be within about 1½ screw diameters from the end of the screw. (2) The angle or contour of the inner slope of the die should be kept smooth and should diverge as gradually as possible from the diameter of the cylinder to the die itself.

In wide extrusions, such as the unit tread and sidewall combinations, it is necessary to choke the center portions and divert the flow to the edges. In such instances, temperature control of the die head, particularly at the edges, in addition to the temperature control maintained at the center of the die head, will have an important bearing on the quality of the extruded product.

The discharge side of the die has a very important role in the smoothness of the extrusion. Sharp or right-angle edges at the discharge end in addition to effecting smoothness will often cause "peelings" to form. A diverging angle should be provided at the discharge side of the die which will produce an ironing effect on the surface of the extruded section.

The swelling in size and shrinkage in length of the extrusion are influenced by the condition of the stock prior to extrusion, that is, the amount of breakdown and temperature at time of feeding, the formulation of the compound, and the pressure of the stock at the die.

The cross-linked polymers, the wide choice of furnace blacks, the fine particle size non-black pigments, all offer the mechanical goods compounder many possibilities for control of swell and shrinkage at extrusion.

A. Gray. Whether an extruded section will tube to size or swell depends entirely upon the coordination between the rate of flow through the die and the rate of take-away from the exit of the die. When these rates are exactly the same, then you have tubed to size. If you increase the rate of take-away without increasing the rate of compound feed, you draw to a smaller-than-die size, and if you decrease the take-away rate below the rate of flow of the compound, the extrusion swells.

Q. What are the most efficient means of controlling breakdown and warm-up to provide uniformity in extrusion with special reference to batch sizes, blending, bank sizes, feed back rollers, etc.?

A. Glaser. The type and the amount of warm-up equipment used will determine the means of obtaining uniformity.

Where mills are used, a good blending arrangement can be made with five mills. Two or three mills are used for warm-up, depending upon the ease with which the stock breaks down and forms a smooth band. The stock is fed from each of these mills, alternately, to a blending mill, then to a feed mill and finally into the extruder.

The warm-up mills should not be overloaded, and the stock should be cut down often enough to insure thorough working of the whole mill load. The rolls should be set fairly tight, and the rate of delivery to the blending mill should be adjusted to keep a uniform volume of stock flowing through this mill to the feed mill. Throw-over bars on the blending and feed mills facilitate the movement of the stock across the mills. Additional blending can be accomplished by taking slabs, alternately, from two batches when the warm-up mills are being loaded.

Obviously, if fewer mills are used, the problem of blending and working is more acute, and the necessity of greater uniformity in the plasticity and cure rate of the batches becomes greater.

Q. What is the simplest laboratory method of duplicating factory extrusion results?

A. Gray. Set up an extruding machine in the laboratory. Many attempts have been made to evaluate extrusion properties without truly extruding, but none of these has ever appeared to be translatable into actual extrusion properties.

Q. What are methods and procedures for making tread shrinkage tests?

A. Glaser. The following method requires a minimum of equipment and allows for shrinkage measurements and comparisons at any time after extrusion and under any special conditions it is desired to impose.

A measuring tape and a marking device which will produce two marks, simultaneously, 40 inches apart on the extruded tread are all that is required. A wooden board approximately 48 inches long with two nails driven through it 40 inches apart may be used.

The marking device is pressed against the extruded tread as soon as possible after it leaves the die, thus providing bench marks 40 inches apart. From this point on, measurements can be made at any time.

A comparison of the measurements made just before the tread is cut to length, with the original 40 inches, will show the effects of conveyor belt speed and cooling.

A comparison of the distance between marks just after cutting and again just prior to application to the tire will provide the shrinkage taking place between these two operations.

Shrinkage with time can be followed by placing the tread on a lubricated surface and making measurements at specified time intervals. Various types of storage (book *vs.* tray, etc.) can be compared by using marked treads from the same run, stored in the various ways being investigated.

Q. What are the clearance tolerances between the screw and the barrel on a tubing machine?

A. Gray. Such tolerances are, of course, a matter of practical expediency. The clearance which we specify on the construction drawing of a 4½-inch screw is 0.020, plus 0.003, minus 0.0 of an inch, and we specify that when the clearance has reached 0.030-inch, the screw must be rebuilt or replaced. This is not to say that 0.030-inch is intolerable, but rather an expression of belief that the screw efficiency diminishes to such an extent as this clearance increases that it is wiser to reduce clearance than to continue with the worn equipment.

Q. What is normal temperature gain through an extruder under normal conditions?

A. Gray. No direct answer can be given to this question. It may be said, however, that the rise in temperature on the way through an extruder depends upon several factors, among which are: temperature of the compound on introduction and the rate at which the material is being forced through the machine, as well as the design of the screw and the machine.

In the room temperature compound process the temperature rises from an assumed 70 to 250° F. If one takes a conventional deep thread screw and feeds it with material at 200° F., however, the temperature rise may be no more than 50° F.

Q. What are the benefits of forced feeding, that is, the use of power-driven rollers in the hopper to provide a constant feed to the screw?

A. Gray. Such rollers, if properly functioning, are very beneficial in that they tend to make the size of the bite taken by the screw at each rotation more uniform. Except in the case of a well-regulated ball or bank which is found when mechanical feeders are used, the bite is quite likely to be variable, which condition causes a difference in the rate of flow of the materials through the extrusion die.

Washington Group Installs Officers

Officers were installed at the Washington Rubber Group's seventh annual banquet held at the National Press Club, Washington, D. C., October 20.

A. W. Sloan, Atlantic Research Corp., acted as toastmaster for the gathering of 110 members, wives, and guests.

Paul Greer, chief of the research and development division, Office of Synthetic Rubber, Reconstruction Finance Corp., will be the Group's president for the coming year, and W. James Sears, vice president of The Rubber Manufacturers Association, Inc., will be vice president.

Other officers installed were William Dunkle, Goodyear Tire & Rubber Co., as secretary; Ethel Levene, materials engineer, Bureau of Ships, as treasurer; and Rachel J. Fanning, research fellow, American Dental Association, National Bureau of Standards, as recording secretary.

Committee chairmen will consist of Robert D. Stiehler, chief of testing and specification section, National Bureau of Standards, program; Charles Collins, The B. F. Goodrich Co., membership; and George W. Flanagan, B. F. Goodrich Chemical Co., publicity.

Hovey Addresses Quebec Group on Extrusion

The Quebec Rubber & Plastics Group, meeting in Montreal, P.Q., Canada, October 21, was addressed by V. M. Hovey, of John Royle & Sons, Paterson, N. J., on the subject of "Extrusion—Past, Present, and Future." The development of extruders and extrusion techniques since the company's founding, as well as an illustrated discussion of new applications and machinery, was presented.

The Group, for the first time in its 14-year history, bestowed honorary memberships, on M. F. Anderson, general manager of Naugatuck Chemicals and the latex and reclaim divisions of Dominion Rubber Co., Ltd., Montreal, and C. D. Bent, chief engineer, cable division, Northern Electric Co., Ltd., Lachine, P.Q.

Parks Speaks on Rigid Vinyl

C. E. Parks, manager of new products development, B. F. Goodrich Chemical Co., Avon Lake, O., addressed the Ontario Rubber Section, CIC, meeting at the Kress Mineral Springs Hotel, Preston, Ont., Canada, November 9. Eighty-five members and guests heard his talk, entitled "Rigid Polyvinyl Chloride Plastics in the United States."

The manufacture of sheet for the rigid

(*Continued on page 396*)

NEWS of the MONTH

Washington Report and National News Summary

IT HAS been reported that four of the 35 firms bidding on the government synthetic rubber plants have reached agreement with the Disposal Commission on prices for the plants they want to buy. No contracts have actually been signed, however, according to Holman D. Pettibone, chairman of the Commission, who in a talk before the annual meeting of The Rubber Manufacturers Association, Inc., in New York, November 18, said that unless some bidders raise their offers, certain plants will not be sold. He still expressed optimism that disposal will be achieved, but reminded the bidders that time is running out.

Business generally in 1955 will be better, but will fall short of the boom year of 1953, according to the opinions expressed by a panel of experts at a symposium on the "Outlook for the Rubber Industry for 1955," which was also a part of the RMA annual meeting on November 18. Unit sales of most rubber products will be higher next year, but few records will be set. The economic situation will be the controlling factor in determining rubber use pattern in 1955. Management in the rubber industry must be progressive, must strive for profitable operations to attract the American investor, and thus meet the challenge of growing markets, it was said.

The General Services Administration wants to replace some of its remilled grades in the stockpile with higher grades and change the present stockpile formula.

Washington Report

By ARTHUR J. KRAFT

Four Synthetic Plant Bids Reported OK; Commission Asks Higher Bids on Others

The Rubber Disposal Commission chalked up a record of solid achievement last month, practically closing deals—on its own price terms—with four of the 35 companies bidding to buy government-owned synthetic rubber plants. The Commission wasn't doing any talking in public about the names of the companies—and plants—involved, but neither was it putting a damper on published reports naming these companies as "successful" bidders: Goodrich-Gulf Chemicals, Inc.; Shell Chemical Corp.; Copolymer Corp.; and American Synthetic Rubber Corp.

All were reported to have agreed to pay the prices sought by the three-member Commission for the plants on which they had entered bids. The plants covered by the four agreements were said to be the following:

The First Four Deals?

Goodrich-Gulf (B. F. Goodrich Co. and Gulf Oil Corp.)—the 90,000-ton-a-year copolymer plant and all or half of the 197,000-ton butadiene plant, both at Port Neches, Tex. The copolymer plant represented a government investment (as of December 31, 1952) of $21,664,000, and the butadiene plant, of $58,357,000.

Shell Chemical—the 89,000-ton copolymer plant, valued at $15,822,000, and the 61,000-ton butadiene plant, valued at $20,281,000, both at Los Angeles, Calif.

Copolymer Corp. (a combine of six medium sized tire companies)—the 49,000-ton copolymer plant, valued at $9,276,000, and the 23,000-ton butadiene plant, valued at $7,711,000, both at Baton Rouge, La.

American Synthetic Rubber (a group of 30 small firms, mostly rubber fabricators, plus a big chemical manufacturer, American Cyanamid Co.)—the 44,000-ton copolymer plant, valued at $8,932,000, located at Louisville, Ky.

Totaling up the figures, that gave the Commission this score, with another month yet to go before the December 27 deadline for winding up contract negotiations: Sold, seven plants, representing an investment of $141,443,000 and capable of producing 272,000 long tons a year of GR-S. Yet to go, 20 plants, a $377 million investment, with an aggregate capacity of 588,000 tons of GR-S and 90,000 tons of Butyl. Actually, the disposal law sets a minimum objective somewhat short of these last two figures. That law states that no program will be approved by Congress unless the plants sold are capable of producing at least 500,000 tons of GR-S and 43,000 tons of Butyl.

With seven plants in the bag by mid-November—the fruit of nearly six months of negotiation between the Commission and prospective buyers—the Commission set forth in earnest for a home-stretch drive to sew up the others. Meanwhile actual signings of contracts with the four firms which had come to terms already was being deferred until others joined the fold.

Pettibone Asks Higher Bids

The Commission made its move November 18, when its chairman, Chicago banker Holman D. Pettibone, appeared before an annual luncheon meeting of the Rubber Manufacturers Association in New York with a softly worded, but nevertheless clear call for more bidders to raise their price offers. Among his audience were representatives of the 35 bidders.

Bidders on some of the plants, he said (without telling how many), have agreed to the "full, fair value" price tags written by the Commission, but others have not.

"Bidders for some of the facilities and the Commission," he reported, "have been unable to find a meeting place on the purchase price. . . . Unless wide divergencies, where they exist between certain bids, can be explained thoroughly and justified, some facilities may not be sold."

This statement, and others throughout his 12-page address, served as a reminder of the Congressional hurdle ahead for the disposal program. Mr. Pettibone, while talking to the industry, had his eye fixed on the 60 days following January 27 when the ultimate fate of disposal will rest in the hands of a Democratic controlled Congress which presumably will be alert for any sign of a "giveaway" deal. Under the disposal law the Commission must submit the proposed contracts—the fruit of the past seven months of negotiations—along with its recommendations and those of the Attorney General—to the Congress. The deadline for that report is January 27. Either the Senate or the House in the

Blackstone Studios

Holman D. Pettibone, Chairman, Rubber Producing Facilities Disposal Commission, Addressing Members and Guests at Thirty-Ninth Annual RMA Meeting

two months following may veto any or all of the proposed contracts. If the veto is exercised even on one contract, all other prospective buyers have the right to back out of their contracts or seek their revision.

Mr. Pettibone hinted rather strongly that time was running out on the companies which have entered bids, but—at the time he spoke—these companies were still resisting the Commission's price demands.

"Concern," he said, "is being expressed in various quarters over the short time left to complete a disposal program. The Commission shares this concern."

After driving home his point, Mr. Pettibone pepped-up the audience—which extended beyond the confines of the Waldorf dining room to the halls of Congress and the jungle estates of Malaya and Indonesia—by declaring: "The Commission remains optimistic that a program can be recommended to the Congress."

Small Volume Rubber Buyers Safeguarded

Mr. Pettibone went into some detail in drawing a picture of the factors that enter the Commission's thinking in meeting one of the prime conditions for disposal—sale at "full, fair value." His comments were briefer—but most hopeful and definitive—when he turned to the other major point which Congress, in the disposal law enacted a year ago, made a condition for its approval. That point dealt with monopoly aspects of a rubber-plant sale program.

While fears of a "giveaway" deal—at least among the Senate Democrats—came in for heavy attention during the heated debate which preceded the law's enactment, even greater concern was expressed over the potential danger to smaller rubber fabricators should the synthetic rubber plants turn up in the hands of the giant rubber and petroleum companies. Both rubber and petroleum manufacturing already are highly concentrated industries, dominated by a relatively few big firms. At the Democrats' insistence the Congress wrote specific safeguards into the law instructing the Commission to protect the synthetic rubber lifeline of small fabricators who will not be able to buy government plants.

"In accordance with the law," Mr. Pettibone told the RMA, "and the Commission's instructions, each bidder has declared his intention to make some specified portion of his production of synthetic rubber available to small business enterprises. The Commission believes that the disposal program now shaping up can provide an adequate supply of non-captive synthetic rubber to meet the needs of the smaller rubber fabricators who do not buy plants."

To make doubly certain that smaller users get the protection that the Congress so earnestly insisted they have, the Commission, during its negotiations, concentrated special attention on those bidders who seemed most likely to sell a major portion of their production to small business. The fact that the two combines of smaller or medium sized fabricators which entered bids were among the first signed up would seem to indicate success for that effort. Moreover, it was commonly assumed that Phillips Chemical Co., with bids in for both the copolymer and butadiene facilities at Borger, Tex., would be among the early signers, chiefly because of its open offer to devote its production of GR-S to meeting the requirements of a host of small consumers at a price—25¢ a pound delivered—which could be hard to beat.

As of late November, however, Phillips and the Commission were reported far apart in their dickering over a fair price for the Borger plants.

No Details Given on Bids

Mr. Pettibone did not name names in discussing the situation to date on negotiations, a situation which, as previously reported in this space, finds a great number of companies (nearly 10) bidding for the one styrene plant; anywhere from one to three companies out for each of the eight petroleum butadiene plants; and little or no competition in the bidding for the great majority of the 13 copolymer plants and the two Butyl plants Mr. Pettibone gave no hint whatever of the competitive pattern of the bidding. He confined his remarks on this point to noting that one of the 13 copolymer plants—the non-operating Institute, W. Va., plant an uneconomic producer—"as yet" has drawn no bid.

Formula for "Full, Fair Value"

Here are some further extracts from Mr. Pettibone's address, outlining the Commission's approach to determining and obtaining "full, fair value" for the synthetic rubber facilities:

"What is 'full, fair value'? Who is to determine it? Three parties are involved—bidders, the Disposal Commission, and the Congress. I shall speak only on the Commission's approach to the problem.

"We have had access to all government accounts concerning the construction and operation of the facilities. We have had the help of the Washington staff of the Office of Synthetic Rubber headed up by our friend, E. D. Kelly.

"We have had before us a complete appraisal report prepared for the Administrator of the Reconstruction Finance Corp. prior to the time of the appointment of this Commission. We have been supplied with quantities of information by bidders either in response to our questions or volunteered. In our study of all of this material the Commission has been assisted by engineers, lawyers, economists, and accountants specially retained for that purpose. Finally, and very important, we have before us the bids of all bidders.

"We gave attention to many factors, including original cost, depreciation as set up in the government accounts, cost of replacement, estimates of cost of building entirely new facilities with different techniques of manufacture. **Keeping all these factors in mind, we have placed emphasis on potential earning power of each facility in the hands of private owners and operators.**

"We do not presume to say that we have hit upon a scientific or exact mathematical formula for determining value which is so accurate as to be conclusive, but having all these data before us, we have been able to form opinions as to appropriate prices for purposes of comparison and negotiation. We have had enough confirmation from various bidders to indicate that our method of approach to the question of value is sound for the sale of a going business.

"Permit me to share with you an important secret: several bidders have informed us quite fully about the defects of the particular facility for which a bid was submitted. That is a rather human trait which we understand—sympathetically. In addition, several bidders have been at some pains to mention superior advantages of a competitive facility not in their bid. We have listened respectfully to the catalog of defects. We have been even more interested in the advantages assigned a competitive plant. It has seemed to us to be appropriate to mention those advantages to the bidder for the other plant.

"There is another item in which we have been interested. . . . One cent a gallon in the cost of butylenes could mean a difference of around $200,000 annually in earnings of a single plant after 50% federal income tax. Capitalize that at a modest 10%, and we seem to arrive at a difference of $2,000,000 in the capital value of the plant. Maybe you prefer to talk about a price of 23¢ per pound for the synthetic rubber known as GR-S. Suppose we increase that figure to 24¢ on 600,000 long tons of production. Would you believe it—that comes out at $13,440,000. Suppose we assume federal income taxes at 50% and capitalize at 10%. My word, the value of all the GR-S plants would be increased by over $50,000,000. At that point, we sign off. The sale price might be 22¢ a pound instead of 24¢.

"It is logical to assume that sales prices

of plants having the same product must bear a relationship to each other. If this were not true, Congress next January might examine the recommended program submitted by the Commission and arch an eyebrow on whether a free, competitive industry was being established. Congress can hardly tolerate a 'bargain' to one bidder, while another is paying a 'full, fair value.' Such a course doesn't appear to start free enterprise off on an even race.

"As of this date, neither the Commission nor any bidder has signed a final definitive contract of sale. These are now in course of preparation with every bidder whose bid is regarded by the Commission as representing full, fair value. We propose to execute these contracts as soon as, in our judgment, there is in the making a program we can recommend to the Congress. This does not necessarily mean a contract covering every facility. If a facility is not sold or leased, it is to be put in standby for three years so that it will not compete with buyers of other facilities. Neither a bidder nor the Commission is bound until the formal contract is signed by both."

Demand Ups Synthetic Production

A swing back to synthetics by the rubber manufacturing industry is now under way. The tip-off came late last month when the Federal Facilities Corp., operator of the government's synthetic rubber plants, announced plans to step up its production of GR-S in December, January, and February to meet an increased flow of orders.

The agency said its customers have put in orders for about 50,000 long tons of GR-S (including oil content) for delivery in December—increasing their orders for the month by 3,500 tons. The industry, which only a month earlier had called upon government factories for 43,000 tons for January delivery, added another 4,000 to that total to bring January orders to 47,000 tons. Thus during late October and early November the industry tossed another 7,500 tons of unexpected business FFC's way.

The agency said that, on the basis of 90-day advance orders received in November, it expects to sell 49,000 tons of GR-S in February, the short-calendar month.

Production will be upped over previously planned schedules to help meet the swell of new orders. December production is being increased only a little—300 tons to 44,600 tons, but January's output schedule will be moved up, according to current plans, by 4,000 tons to 48,000 tons. The agency will turn out 44,000 tons in February, withdrawing from its substantial inventories to meet a 5,000-ton deficit.

FFC found two reasons for its recovered prosperity, after the months-long slump in synthetic sales of the past summer. Credit for the revival in synthetics, it said, should go to "the current increase in the consumption of overall new rubber hydrocarbon, together with present higher natural rubber prices."

For the record—FFC reported final October sales of 45,354 long tons of GR-S and 4,964 tons of Butyl. Included in the former was 4,637 tons of latex, the highest since March, 1953. October output was 41,859 tons for GR-S (inventory withdrawal made up the deficit) and 5,029 tons for Butyl. November's schedule called for production of 40,800 tons of GR-S—the same daily rate as in October—while sales were estimated at 43,000 tons. Butyl output was slated at 5,000 tons. FFC's inventory of GR-S was 67,000 tons on October 31, down 3,400 tons in the month.

FFC's tentative production schedule for December calls for 44,600 long tons of GR-S, of which 78% (34,788 tons) will be LTP GR-S. The November output schedule has been revised upward to 44,800 tons, of which 70% (31,360) is LTP. The final revised figure for October sales is 45,468 tons, including 31,299 tons of LTP.

Almost all of the anticipated increase in demand for December will be covered by an expansion in production of oil-extended GR-S. FFC's present production plans for December call for making 16,600 tons of oil masterbatch GR-S, compared with the 12,800 tons scheduled for November and with October's sales figure of 12,667 tons.

FFC, with near-record GR-S latex sales in October (4,637 tons) figures on seeing all previous highs broken in the next few months, largely as a result of stepped-up demand for foam cushioning for the auto makers. FFC has scheduled latex output at 4,801 tons in November and at 5,000 tons in December, figures which can be met by getting every last ounce from existing plant capacity.

The agency reported October sales of 4,964 tons of Butyl rubber and plans to produce 5,000 tons in November. October sales of black masterbatch (GR-S) amounted to 4,985 tons and of the oil black-masterbatch to 2,404 tons. November output was set for 3,000 tons of black masterbatch and 2,900 tons of oil black-masterbatch. The December schedule calls for 4,465 tons of the former. While the black masterbatch sold in October included some 122° F. GR-S, November and December output will be entirely of LTP types.

Styrene-for-GR-S Price Hassle

The Federal Facilities Corp. and three major styrene producers are at odds over price terms in their effort to negotiate new contracts for supplying styrene to the government's synthetic rubber program.

Current contracts,[1] expiring or already expired, provide for delivery f.o.b. plant at prices below those charged by the same suppliers to non-government customers. Private consumers, however, buy on an f.o.b. basing point basis. FFC wants its contracts with the three suppliers revised to provide f.o.b. basing point delivery also and has suggested Institute, W. Va.—where it has a currently "mothballed copolymer plant—as a basing point.

The three big private suppliers—Dow, Monsanto, and Koppers—thus far have resisted this proposed switch on the ground that it would reduce by 1¢ to 1.5¢ a pound the price they receive from the government. Current contracts, and presumably any new ones negotiated, already give FFC more favorable prices than accorded to private customers, and the three producers contend they should not be required to go any lower through a change to a basing point price for FFC.

Another dispute slowing up the negotiations has been the inability—at this writing—of the three producers to agree among themselves how large a share each will supply to FFC. The agency, in the coming year, will meet 42% of its styrene requirements from its own plant at Los Angeles, the only styrene plant now under government ownership.

The remaining 58%—the lion's share of an estimated 100,000-ton-a-year styrene requirement—has been set aside to be filled by private industry. The three firms, however, have yet to agree on how to slice their part of the pie.

[1] See our Oct., 1954, issue, p. 92.

GSA Wants Less Low Grades in Stockpile

The General Services Administration, which manages the million-ton-plus natural rubber strategic stockpile, served notice a few weeks ago that it is dissatisfied with the present stockpile formula.

Object of the dissatisfaction is the large portion of low-grade remilled wet slab rubber now in the stockpile and subject to frequent rotation.

Varying estimates put the total of remilled grades at 50,000 to 120,000 tons—anywhere from under 5% to about 10% of the aggregate amount of crude natural rubber held by the government.

GSA wants to cut down on its horde of remilled grades, doing it gradually. Its reasons are twofold, but boil down to a matter of saving money.

The remilled grades—most #3 Ambers and #2 Browns along with some #2 Ambers and #1 Browns—require frequent replacement because they deteriorate after relatively brief storage. Replacement, under present stockpile policies, means selling out the stockpile rubber to private users and buying for the stockpile an equal amount of the identical, or similar, grades. This means frequent rotation of the low-grade rubber, and rotation costs money.

On top of this, GSA has been finding it difficult to obtain these remilled grades on the market in adequate quantity to rotate at a desirable pace. Spot market prices of remilleds on occasion have been out of balance—on the high side—with those of the better grades. Most of the remilleds offered are of Singapore types; whereas GSA must buy RMA types.

The agency called in its rubber industry advisory committee in late October to find some answer to this double-bite. What GSA would like to do—if it can get industry's backing—is to start replacing some of its remilled rubber with better, longer-storing grades such as #1, #2 and #3 Ribbed Smoked Sheets.

The industry agreed to consider the problem and handed it to a special technical subcommittee. While views are still not firmed up, the initial reaction was not all GSA's way. The big consumers like the present stockpile pattern. The present ratio of lower to higher grades conforms with existing compounding formulae. The remilled Ambers and Browns from GSA's stocks reportedly are available to consumers at a price discount.

Natural Producers Prefer Stable Price

Rising prices for natural rubber were attributed last month to a "good underlying factory demand" rather than "any unusual speculative element."

This conclusion was drawn by H. C. Bugbee, president of the Natural Rubber Bureau, the American offshoot and fre-

quent spokesman of the British and Malayan rubber producing industry.

The producing industry, Mr. Bugbee said, would much prefer a stable price for natural rubber than either a "runaway price" or an "unsound drop" in prices. Producers, he said, are "not responsible" for the recent upswing which has brought natural rubber prices some 5¢ a pound above the price of American synthetic GR-S.

"Buyers," he declared, "have not shunned these higher levels. On the contrary, they have created them, with a good underlying factory demand being a greater factor than any unusual speculative element."

While the "tight statistical position and some genuine fear of uncertain political developments in the producing areas" have contributed to the upward price movement, "there has also been a strong demand for natural which has not been hurt by the rapid strides in the original equipment demands for the tubeless tire or the good prospects of overall high demand for tires in the fourth quarter," Mr. Bugbee wrote in the November issue of the Bureau's monthly publication, *Natural Rubber News*.

Continued high prices for natural rubber, he said, "can be expected to cause two results over a period of time. One is increased natural rubber production, particularly on the part of the Indonesian small rubber farmer, who comes back into the market to take advantage of the higher return. The other is a shift by rubber manufacturers from the natural to the synthetic product."

Under the free market now prevailing for natural, this response ultimately results in more ample crude rubber supplies available to purchasers and a drop in prices, Mr. Bugbee noted. The fact that a shift by manufacturers from natural to higher percentages of synthetic did not actually take place in September (the latest figures available at the time Mr. Bugbee wrote) merely reflected "the fact that such shifts take longer to make than most people realize—and very little shifting is being done during this uncertain period of negotiation for synthetic rubber plants, and when production of the new tubeless tires seems on the whole to be a plus factor for natural."

The shifting back and forth, following sharp price fluctuations, is inherent in the free, uncontrolled production and marketing of crude natural rubber, Mr. Bugbee contended. Of more immediate concern is whether the producing industry will be able to hold its own against the prospective advances in synthetic rubber technology.

Mr. Bugbee thinks the outlook is good, if the natural rubber industry attains the goals it has set for itself in "the immediate months ahead. They are: (1) a fully competitively priced product; (2) a commercially priced synthetic; (3) a major replanting program; and (4) increased production research and consumption technical service.

"As the balance between world production and world consumption of all rubbers nears, the one dominant fact is that there is room for *full utilization of efficient production* of both natural and synthetic rubber at a profitable level. In a free enterprise system that can only result in more and better rubber products at reasonable prices [the italics are Mr. Bugbee's].

"The entire rubber industry—natural producer, synthetic producer, reclaimer, importer, and manufacturer—has a great opportunity to pull together, and the real start should be the hoped-for 1955 creation of the privately owned synthetic rubber industry," Mr. Bugbee said.

National News

RMA Annual Meeting Panel on "Outlook for the Rubber Industry in 1955"

The thirty-ninth annual meeting of The Rubber Manufacturers Association, Inc., held at the Waldorf Astoria, New York, N. Y., November 18, was featured by a symposium-type program entitled, "Outlook for the Rubber Industry in 1955," in the morning, and an address at luncheon by Holman D. Pettibone, chairman of the Rubber Producing Facilities Disposal Commission, on "The Synthetic Rubber Plant Disposal Program." The annual meeting of RMA members and the Association's directors was held in the afternoon.

A summary of Mr. Pettibone's talk together with some other items of interest in connection with the Disposal Program appears above in the Washington Report.

The meeting was attended by about 160 representatives of 92 rubber manufacturing companies. At luncheon an additional 38 representatives from 20 chemical and petroleum companies joined the rubber manufacturers to hear Mr. Pettibone's talk.

At the morning session RMA President A. L. Viles welcomed those present and then turned the meeting over to W. J. Sears, Association vice president. After reviewing briefly the growth of the rubber industry since the incorporation of the RMA in 1915, Mr. Sears said that no one knows what really lies ahead, but that the panel of experts would review the 1955 outlook for the industry. The discussion will demonstrate the many problems that must be considered in making forward estimates, and how they are approached, he added.

"Product Demand and Rubber Requirements"

D. E. Carson, director of business re-

TABLE 1. COMPARISON OF 1954 AND 1955 ESTIMATES

Item	1954	1955	% Increase 1955 over 1954
Gross national product	$357 billion	$364 billion	2
Industrial production, aver. Federal Reserve Board index	125	130	4
Production of passenger cars	5,350,000	5,400,000	1
Trucks	1,000,000	1,070,000	7
No. of vehicles in operation, over 2 years old:			
Passenger	32,700,000	33,800,000	3.5
Truck	7,500,000	7,650,000	2.0
Passenger tire replacement sales	47,000,000	48,300,000	2.8
Truck tire replacement sales	7,780,000	8,000,000	2.8
Total new rubber consumption, LT			
USA	1,205,000	1,255,000	4.1
Rest of world	1,185,000	1,235,000	4.2
Total	2,390,000	2,490,000	
Natural rubber production, LT			
Malaya			
Estates	345,000	345,000	
Smallholders	230,000	230,000	
Total	575,000	575,000	
Indonesia			
Estates	280,000	280,000	
Smallholders	420,000	415,000	
Total	700,000	695,000	
Ceylon	100,000	95,000	
Thailand	105,000	105,000	
All others	250,000	255,000	
Natural rubber total	1,730,000	1,725,000	
Synthetic rubber needed to balance (total consumption less natural rubber production)	660,000	765,000	15.9
Synthetic rubber, LT	(approx. prod.)	(capacity)	
USA	627,000	900,000	
Rest of world	90,000	91,000	
Total	717,000	991,000	

NOTES: USA synthetic rubber figure for 1955 does not include capacity from alcohol butadiene. Natural rubber consumption figures and synthetic rubber production figures are exclusive of China, Russia, and satellites.

Blackstone Studios

One-Half of Speaker's Table at Luncheon, Thirty-Ninth Annual RMA Meeting: *(Left to Right)*, Hugh Bullock, Pres., Tyer Rubber Co.; Harry F. Smith, Vice Pres., Raybestos-Manhattan, Inc.; J. P. Seiberling, Pres., Seiberling Rubber Co.; H. Gordon Smith, Exec. Vice Pres., U. S. Rubber Co.; W. S. Richardson, Pres., B. F. Goodrich Co.; Leslie R. Rounds, Commissioner, RPFDC; Lee R. Jackson, Pres., Firestone Tire & Rubber Co.; Willis Armstrong, U. S. Dept. of State; Paul W. Litchfield, Chm. of Board, Goodyear Tire & Rubber Co.; and Holman D. Pettibone, Chairman, RPFDC

Blackstone Studios

One-Half of Speaker's Table at Luncheon, Thirty-Ninth Annual RMA Meeting: *(Left to Right)*, Mr. Pettibone; A. L. Viles, Pres., RMA; Laurence B. Robbins, Ass't Sec'y, U. S. Treasury and Administrator, FCC; H. E. Humphreys, Pres., U. S. Rubber; Everett R. Cook, Commissioner, RPFDC; J. L. Collyer, Chm. of Board, B. F. Goodrich Co.; Eugene Holland, Exec. Dir., RPFDC; O. G. Vinnedge, Vice Pres., Dryden Rubber Div., Sheller Mfg. Corp.; E. J. Thomas, Pres., Goodyear Tire & Rubber Co.; Donald D. Hogate, Consultant, RPFDC; A. A. Garthwaite, Pres., Lee Rubber & Tire Corp.

search, The B. F. Goodrich Co., was the first speaker; his subject was "Product Demand and Rubber Requirements." Basic to any forecast of product demand is an estimate of the total economic activity for the period ahead, he said. The best yardstick in the United States is the gross national product, which is an approximation of the total value, at the price paid by the final consumer, of all the goods and services produced in this country.

Table 1 (page 385) provides a comparison of 1954 and 1955 estimates on not only gross national product, but many other items of direct interest to the rubber industry.

The gross national product for 1954 at $357 billion is 2% below that for 1953. The estimate for 1955 of $364 billion is in line with the views of the better economists, Mr. Carson said.

Activities expected to be relatively strong in 1955 were given as residential, commercial, and public construction; major appliances, such as television, refrigerators, and home freezers; passenger cars; and trucks.

In summary, the consensus is that business generally will be somewhat higher in 1955 than in 1954, but not so high as the boom year of 1953.

For the rubber products manufacturing industry, the most important estimates are those of vehicle production and vehicles in operation, for these are the figures which will determine the sales of tires and a wide variety of industrial products. Unfortunately, no one now knows how to forecast vehicle production with a high degree of accuracy, Mr. Carson said.

He explained that the most recent estimates of the RMA statistical committee on the production of passenger cars in 1955 ranged from a low of 5,200,000 to a high of 5,750,000, with the average being 5,400,000. Based solely on the demand for transportation, the lower figure would be satisfactory, but the major changes in the 1955 cars and the relaxing of credit restrictions may stimulate sales sufficiently to exceed the average figure. The estimate for 1955 production of trucks was considered a reasonable figure.

The number of vehicles more than two years of age in operation, which is the

primary tire replacement market, will increase in 1955, and the composite estimates of replacement tire sales are considered to be conservative. Since the number of cars in the replacement market will be 3.5% higher, as compared with the 2.8% increase in the tire replacement market, this means that allowances have been made for improved tire quality and recapping.

The increase in the number of trucks in the tire replacement market and the indicated higher rate of economic activity in 1955 justify the estimated increase of 2.8% in this tire replacement market.

For many years there has been a close relation between dry rubber consumed in non-transportation products and the Federal Reserve Board industrial production index, with double weight given to the consumer durable goods segment. Because the production of both durable goods and motor vehicles is expected to be higher in 1955 than in 1954, we anticipate a small increase in the sales of industrial rubber products in 1955, it was stated.

The large volume of residential and commercial construction forecast for 1955 points to a large market for floor coverings. Latex foam products should continue their better-than-average growth. Drug sundries should grow with the population. Rubber footwear volume is largely unpredictable, but canvas footwear volume should increase in 1955.

In summary, unit sales of most rubber products will be higher in 1955, but few new records will be set. Total new rubber consumption is therefore expected to increase by about 4% in 1955, with consumption in non-transportation products being a higher percentage of the total than in previous years.

"Technical Requirements"

The technical requirements and aspects of rubber usage have not changed materially over the past year, according to J. N. Street, director of laboratories, Firestone Tire & Rubber Co.

Approximately 80% of the new rubber requirements during 1954 has been met by dry natural rubber and GR-S. The area of usage in which natural rubber is preferred from a quality standpoint is 27% of the total natural plus GR-S requirements for milled rubber compounds; the area where GR-S is preferred is estimated at 38%; and the intermediate area where the choice of the two materials depends almost entirely on relative prices is 35%.

These three areas are not actually "completely black or white," but all of them involve a certain degree of "gray," Dr. Street pointed out. Under extreme price differentials these quality limitations on usage might be expected to yield somewhat.

There occurs an appreciable lag in making conversions from one material to another with changing prices. Some products can be changed over relatively quickly, but the revision of manufacturing specifications on many other large-volume rubber consuming products involves complications that take time. However, as time goes on and more experience is obtained, means of overcoming these retarding influences will, undoubtedly, be found.

The **specialty rubbers** as a group (including Butyl rubber) comprise about 11% of the total new rubber consumed. Outlets for these rubbers will continue to grow at a rate somewhat more rapid than the general growth pattern for all types of rubber, it was said.

Latex usage, both natural and GR-S, now makes up 9% of the total new rubber usage in the USA, and the growing demand for foamed rubber products is one of the major items for the increase in latex consumption over the past few years.

Natural latex is definitely preferred in certain products and is used at a level of from 80 to 100% of the contained rubber. In other lines the natural latex content may vary between 40 and 60% of the total; the remainder is GR-S latex. Recently, modified types of LTP GR-S latex have been developed that may result in their usage being expanded in 1955 because they permit higher percentages in the above combinations and may also expand the line of products using synthetic latices only.

Oil extended GR-S has had many problems in connection with its use, but progress has been steady and is expected to continue. The level of usage in 1953 was about 22% of total GR-S; in 1954 this figure should increase to 30%, and in 1955 might be expected to amount to 40%.

In addition, the average amount of oil used in the masterbatch has increased from 25% in 1951 to 34.2% in 1954. As answers to processing and product problems are developed, still further increase in oil content is expected.

GR-S carbon black masterbatch usage seems to have leveled off. One of the major factors involved is the demand on mixing capacity in the industry. Beyond this, price, freight rates, inventory problems, and technical control of the black itself will be the controlling factors in the future choice as to whether to use masterbatch or free flack with GR-S.

In conclusion, Dr. Street said that the economic situation will be more of a controlling factor than technical problems in connection with the rubber use pattern of 1955. While there will be some modification and improvement in one or more types of GR-S, it is not anticipated that these will be of sufficient magnitude to alter materially the situation, he added.

"Natural Rubber Supply—Production Problems"

G. M. Tisdale, vice president, United States Rubber Co., discussed natural rubber supply, with special reference to production problems, in terms of Indonesia, Malaya, and all other supply sources.

Indonesia reached a maximum output of 650,000 long tons in 1941 before World War II. In 1951, total output reached a new high of 814,000, influenced by the 80¢-a-pound price at the time of the Korean War. Smallholders' output declined drastically, when the price receded, and advanced again as the price rose.

Since 1951, estate output has been inhibited by the unfavorable political climate, and estates will be quite lucky, Mr. Tisdale said, if the present level of 23,000 tons a month can be maintained in the future.

Very little is being done in the way of replanting except by estate companies of their own volition. There is no incentive for the smallholders to start replanting, and none is being done.

Production for 1954 is estimated at 700,000 tons for Indonesia, with the possibility that if the stimulation of higher prices continues into the fourth quarter of this year, total output might reach 750,000 tons.

Malaya after World War II reached a maximum production of 698,000 long tons in 1948, and no increase over this figure was achieved during the Korean War period, with both estates and smallholders affected.

Replanting on Malayan estates has averaged better than 2% of the planted areas per year in the postwar period, and more than 15% is now completed, with some areas already in bearing. There is a government scheme for replanting smallholders' rubber financed by a cess on rubber exports. There are 937,000 acres of smallholders' rubber more than 30 years old, and 500,000 acres are to be replanted by 1960.

Although Malayan production in 1954 and 1955 will be about 575,000 tons a year, the long-term future production of this country should be increased considerably.

Other producing countries, such as Ceylon, show some replanting under way, but only 10% of the planted area is involved over the next five years. Not much has been heard of replanting activities in Sarawak, Borneo, Thailand, and Indo-China, and these areas will be handicapped in the future unless considerable modernization is achieved, it was said.

In Africa, the Liberian plantations are experiencing slower growth, and about 40,000 tons a year is the expected maximum for the near future. B. F. Goodrich is entering production in Liberia, and within seven to 10 years some increase in production should be achieved. Belgian Africa will ship 25,000 tons in 1954, and British Africa will turn out 22,000 tons, continuing the rise that has been evident during the entire postwar period.

In Brazil, the government requires all rubber consumers to contribute 20% of their net profits toward replanting, which scheme is designed to make the country self-sufficient in rubber supply.

Consumption of rubber in Latin American countries is running at the rate of 85,000 tons a year; whereas natural rubber production in the entire Western Hemisphere is only 34,000 tons. Thus imports on balance must be the outlook for a long period ahead.

Mr. Tisdale concluded that the production in the natural rubber industry can only trend downward, except for price stimulus, in the next several years before the replanting schemes and hoped-for revisions in government policies can be effective in arresting the decay and stabilizing the industry.

"Natural Rubber Supply—Political Factors"

Willis C. Armstrong, acting director, Office of International Materials Policy, U. S. Department of State, emphasized that the most important political force in natural rubber producing areas of Southeast Asia is nationalism and that we should recognize and assist legitimate nationalist aspirations, cooperating with nationalist movements to the end that they achieve the kind of economic and political independence we cherish ourselves.

Another major political force at work in Asia is Communism, and in underdeveloped areas Communism operates under the guise of nationalism where present-day nationalist leaders do not or will not recognize the pseudo-nationalist Communists.

The Western powers long ago realized the predominance in Asia of nationalist forces and have acted accordingly by giving independence in many instances, or yielding in other ways, sometimes not so gracefully, to the rising nationalist tide, Mr. Armstrong said. It is a matter of very real concern to the Wesern world, as well as a case of self-interest, that nationalism in Asia be genuine and that the newly independent countries not lose their independence to the Communists.

We must also remember that nationalist reluctance of certain Asian governments to associate themselves with Western plans for collective security does not necessarily

mean that they are adopting an isolationist view. Another factor which we must remember is that Asian nationalism is much preoccupied with economic development. In particular, major export commodities are a matter of more than unusual concern for if their export markets collapse, so do their development plans, and so can the governments themselves.

The purpose of American policy in Southeast Asia must include international security, genuine political independence, sound economic progress, and rising levels of living. To achieve these objectives we must work with the Asians themselves and their governments to demonstrate that we desire trade and investment opportunities on a mutually profitable basis, that we are prepared to help in the development of sound national economies, and that we ask only for a square deal. If we are patient and friendly, we may be able to help the new, proud, but still inexperienced national movements. If we are impatient, harsh, and superior in our attitude, there will be a decline in our influence and our business, which would not serve our national interests, and our national interests are coincidental with our business interests, Mr. Armstrong concluded.

"Synthetic Rubber Supply—Government Production"

E. D. Kelly, director, Office of Synthetic Rubber, Federal Facilities Corp., in discussing synthetic rubber supply divided his talk into two parts, government production under current conditions, and government production if the disposal program fails.

Government production under current conditions is an operation as nearly like a private multi-plant company's operation as it can possibly be and still have government ownership and supervision, he said. Because of the excellent cooperation between government and industry that has existed, we can say that the Government Synthetic Rubber Program has been a solid success.

Although it is true in many respects that the government operates a virtual monopoly in the synthetic rubber field in the United States, there is great competition between natural rubber produced in foreign countries and synthetic rubber produced in this country, the government's fixed price for this synthetic rubber notwithstanding.

The new sales policy, which holds speculation on forward sales at a minimum, makes production scheduling much easier. In addition, contracts for feedstocks have been made flexible enough so that they can be raised or lowered within certain limits according to the pattern of sales submitted to the Federal Facilities Corp. by its customers well in advance of actual delivery.

If the disposal program under Public Law 205 fails to materialize, the Rubber Act of 1948, as amended, may be continued until 1956, or beyond. If the government continues in the synthetic rubber business, the program would be operated, probably, on a more bureaucratic basis, and industry participation would tend to diminish rather than increase. Capital expenditures to provide for the expected increased consumption of synthetic rubber would be required and would probably involve additional latex facilities, oil extended-rubber facilities, and LTP GR-S facilities. Research would have to continue as in the past and at a level of $4 million or more a year, which would probably reduce expenditures in that direction by private industry.

The current profit position in the neighborhood of 15% on sales might be increased if the government continued to own and operate the plants.

"Synthetic Rubber—Potential Private Production"

L. E. Spencer, assistant to the president, Goodyear Tire & Rubber Co., commended the government's Office of Synthetic Rubber for an outstanding performance in connection with the synthetic rubber program since its inception 12 years ago, but added that the industry felt that the government may now safely and advantageously use these talents eleswhere.

Private industry expects to shoulder its own responsibilities in connection with the nation's needs for synthetic rubber. It expects that all facilities now in operation will continue in operation and that inventories of GR-S and Butyl rubber and of component materials will be maintained at a somewhat higher level in total than has been the practice of the government. This procedure will be necessary inasmuch as individual producers will bear the responsibility for supplying their customers within their own capacity limitations.

When and if the demand warrants, additional capacity will be built well in advance of actual need because of the uncertainties of the availability of natural rubber from other continents. Thus it seems likely that the actual operating level will always be considerably below capacity, and this circumstance will increase production costs. In view of the risks of interrupted supplies of natural rubber and of synthetic plant catastrophes and work stoppages, such extra production costs may well be justified, Mr. Spencer added.

It is expected that the government, while it remains in business, will maintain a normal two-month inventory which may be utilized to bridge the gap between transfer dates and the time when producers and consumers will have established regular commercial relations. In addition, consumers were advised to increase their own inventories to the maximum extent possible, particularly on low volume and specialty types of synthetic rubbers.

Competition for customers is expected to be keen at the outset of private industry operation, and customers can therefore be assured of adequate supplies and excellent service.

Research directed toward the development of new and superior types of synthetic rubber will be expanded sharply, and fabricators may anticipate new and improved materials as a result of this increased emphasis on industrial research and development.

Summary and Conclusions

Mr. Sears summarized the main points made by the several speakers and emphasized that this analysis of the outlook for 1955 demonstrates again that the rubber goods manufacturing industry is a growth industry looking forward to new horizons. To meet this growth, an increase in capital investment will probably be necessary. Management in the rubber industry must be progressive, must strive for profitable operations to attract the American investor, and thus meet the challenge of growing markets.

Tire Prices Increased

An increase of 5% in the consumer list price of all passenger-car tires, small truck tires, and farm tractor tires, effective November 1, was announced by the Goodyear company on October 31. The prices of larger truck tires are being adjusted within the 5% range on a basis of size.

The reasons given for the price increases were the recent advances in the price of natural rubber and the wage increases granted the United Rubber Workers of America, CIO, union last summer.

U. S. Rubber, Firestone, Seiberling Rubber Co., all made similar price advances within a few days after the Goodyear announcement. It is expected that other tire companies will also announce tire price advances.

Goodyear also announced price advances of about 5% for its shoe products line in late October.

Chemical Industry Expansion Outlays Total $2.73 Billion

According to an announcement of the Manufacturing Chemists Association, the chemical industry has completed privately financed construction projects representing an investment of more than $1.2 billion during the 12 months ended October 31, 1954, and has under construction or definitely planned another $1.5 billion. These figures result from a survey made by the MCA which covered more than 570 non-government financed projects of the industry, 215 of which were completed between November 1, 1953, and October 31, 1954. Now being built are 219 projects, at an estimated total cost of $933 million, and another 138 projects, to be built at an estimated cost of $581 million, have been definitely committed. The total of projects completed this year, and those now under construction or planned, most of which will be completed within three years, is $2.73 billion.

Consolidation of completed, under construction, or planned figures shows that in this period the industry is making its heaviest investment, $657 million, in a wide general group of chemicals. *The second largest investment, $616 million is in the field of polymeric materials, chiefly plastics.* [Italics ours.—Editor.] The third largest, $595 million, is for agricultural chemicals, and the fourth largest, $467 million, is for synthetic organic chemicals. More than $57 million is being spent for new research facilities.

The MCA survey differs from government and other statistics in two important respects and cannot be accurately related to these figures, the MCA says. First, instead of calculating money spent on construction in any given period, it classifies projects by those completed, now under construction, or definitely planned.

Second, unlike government statistics, which are classified according to the main product lines of corporations, the MCA survey includes chemical facilities regardless of the main business of the builder. It therefore takes into account the large chemical investments made by the rubber, petroleum, steel, pulp and paper, and other types of companies. The MCA is planning to carry out its new type of survey on a year-to-year basis.

Move to Larger Quarters

The Cincinnati office of Givaudan-Delawanna, Inc., and its associate companies, Givaudan Flavors, Inc., and Sindar Corp., has been moved to larger quarters in The Transportation Building, 307 E. Fourth St., Cincinnati 2, O.

Other Industry News

RMA President Viles Retires; Succeeded by Ormsby

The retirement of A. L. Viles as president of The Rubber Manufacturers Association, Inc., and its active head for 36 years was announced in early November, to become effective January 1, 1955. Mr. Viles was general manager of the RMA from 1919 to 1935. He has held the office of president since 1935. Mr. Viles will continue his association with the organization in the capacity of general consultant.

Ross R. Ormsby, vice president and general counsel of the Association, has been named by the RMA board of directors to succeed Mr. Viles as president. Mr. Ormsby joined the Association in 1944 as chairman of the RMA manufacturing committte. He was elected vice president and general counsel in 1949.

Mr. Viles is almost as well known among rubber producing and trading interests in England, Europe, and Southeast Asia as he is in the American business community. His activities in connection with problems confronting the domestic industry have touched on almost every facet of rubber goods manufacturing. He has served in many advisory capacities to the various agencies of government concerned with rubber in times of peace and war, including service on advisory bodies of the State Department, the Munitions Board, Rubber Reserve Co., and others.

Mr. Viles served as the American representative on the International Rubber Regulation Committee (1934-1943), and was in on the organization of the International Rubber Study Group, serving as United States delegate in the capacity of an industry advisor. Since the organization of the IRSG in 1949, he has attended meetings in such places as London, Paris, Brussels, Rome, The Hague, Copenhagen, and Ottawa.

Recent statements made in connection with Mr. Viles' retirement by top executives of leading rubber companies express very well the high esteem in which he is held by the industry he has served.

John L. Collyer, chairman of the board, The B. F. Goodrich Co., was quoted as saying that Mr. Viles has made "many notable contributions to the progress and growth of the rubber industry. His character, leadership and wise counsel have earned for him the sincere appreciation of his services and the good wishes of the entire industry in this well-merited retirement from active service."

Lee R. Jackson, president of the Firestone Tire & Rubber Co., was quoted as saying that the rubber industry "was very fortunate in having Al Viles as its president for so many years. His devotion to the best interests of the rubber industry has had a constructive influence upon its progress. His outstanding ability as a leader in the work of the Association has contributed greatly to its success. All of us who have known him value his friendship and association highly. We wish him continued good health and enjoyment in his retirement."

Blackstone Studios

A. L. Viles

Blackstone Studios

Ross R. Ormsby

Mr. Ormsby, the new RMA president, attended Akron University and Bucknell University where he received his A.B. degree in 1927. He was graduated from Western Reserve University Law School in 1930, when he was admitted to the Ohio Bar. Prior to joining the Association, Mr. Ormsby had been general manager of the Employers Association of Summit County, O., at Akron, his home.

He practised law in Akron and in 1932-33 served as assistant law director for the city of Akron. In 1934-36 he served as special counsel for the then-Ohio Attorney General, John W. Bricker. Later as special counsel for the then-Attorney General, Thomas J. Herbert, Mr. Ormsby directed the legal work in connection with the liquidation of the old First Central Trust Co. of Akron from 1939 until 1943, when he took his position with the Employers Association of Summit County.

Develops Low-Cost Spray Drying Process

The perfection of a low-cost spray drying process has resulted in the development of two new products—ASP 1200, aluminum silicate pigments, and Spray-Satin, a high-quality paper coating clay—according to Minerals & Chemicals Corp. of America, Metuchen, N. J.

The problem of making the 58-60% solids cake flow freely enough to be spray dried successfully was solved by the addition of a dispersant which allowed the dryer to expend only enough heat energy to dry out 40% water, instead of the former 60%, the company reports. This innovation lowered production costs, sped up production time, and improved uniformity of product.

ASP 1200 is applicable to the manufacture of paints, plastics, rubber, adhesives, printing inks, and leather, the company states, and Spray-Satin is a coating clay that gives a finished sheet of paper excellent opacity and sheen without heavy calendering.

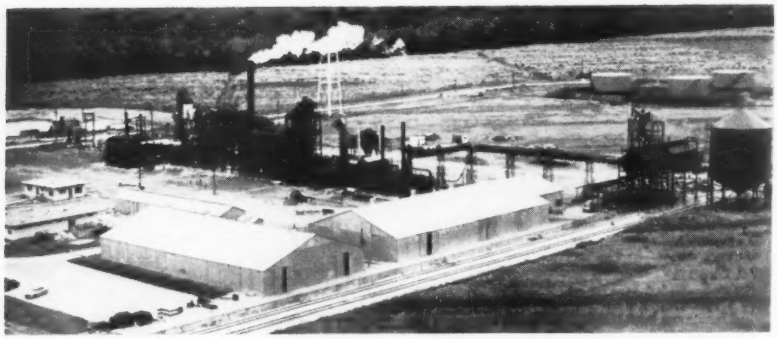
Rename Du Pont Fine Silica "Valron"

"Valron" has been adopted by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., as the trade mark for the estersil formerly known as Du Pont Fine Silica. The material is a completely synthetic, surface esterfied silica which imparts outstanding improvements in physical properties of silicone rubber and other elastomers when used as a reinforcing filler, according to the company.

The use of the estersil is said to permit the manufacture of silicone rubber with a tensile strength of 1,600 psi. and a tear strength of 200-300 pounds per linear inch. Previous silicone rubbers had a tensile strength of 800-900 psi. and a tear strength of 100 pounds per linear inch, du Pont reveals.

"Valron" is organophilic and hydrophobic and is composed of spherical particles 8-10 millimicrons in diameter, suggesting such uses as a thickener for resins, printing inks, paints, and other organic systems, as a filler to increase strength, abrasion resistance, and toughness of plastics and resins, as an anti-caking agent, a thermal insulation agent, and as an agent for imparting slip resistance to solvent-type waxes, the company reports.

Columbian Carbon Completes First New Producing Unit



First Unit of Three-Unit Plant of Columbian Carbon Co. Recently Completed at St. Mary Parish, La.

Completion of the first unit of its proposed $3,000,000 three-unit North Bend carbon black producing plant in St. Mary Parish near Franklin, La., was recently announced by Columbian Carbon Co. An annual production quota of 20 million pounds of carbon black has been estimated for each unit, the last of which is expected to be ready for operation toward the end of 1955.

The oil raw material for the plant is barged in from Gulf Coast refineries, and gas is supplied by fields in the area, according to the company. Latest refinements in automatic controls have been incorporated, and the plant is said to be the first in the carbon black industry to install a graphic control panel of the type employed by modern oil refineries.

Among the various types of carbon black to be manufactured is Statex 125, said to improve greatly wear resistance in tire treads. A series of truck tires compounded with the material was recently on exhibition at the Akron, O., offices of Binney & Smith, Inc., distributor for Columbian Carbon Co. The tires, a 50-50 blend of natural and cold rubbers, incorporating 42 parts of Statex 125, had undergone extensive road tests and were reported to have demonstrated a reduced rate of wear and elimination of cracking.

The North Bend plant will employ patented processes developed by Columbian Carbon's research staff near Monroe, La. The collection system is said to include an electrical precipitator, three stages of cyclone collection, and a bag filter of improved design. In the bag collector, filter bags of special silicone-treated glass fiber replace the synthetic fiber bags previously used, the company reports, resulting in an overall collection efficiency of almost 100%.

The pelletized carbon black is packaged in multiwall paper bags or shipped in bulk in special, covered hopper cars. A feature of the new plant is improved equipment for automatic filling and weighing of valve-type bags, which permits the product to be confined within a closed system from the time of formation until it is used in the customer's plant. Earlier equipment of this type did not meet the accurate weight tolerances required by the rubber industry or tended to destroy the carbon black pellets, it was said.

Statistics released by the company reveal that more than a billion pounds of carbon black are required annually for the rubber industry, most of which goes into tires. More than 11 million pounds are consumed annually in the reinforcement and fortification of paint films to protect property, machinery, and industrial production facilities from corrosion and deterioration.

New G-E Compounding System

Installation of a complete, semi-continuous compounding system at the phenolic products plant of General Electric Co., Pittsfield, Mass., is expected to provide a 60% boost in plant capacity over previous production levels, according to the company. Components for the new system include blending equipment, grinders and pneumatic conveying systems, classifying system, and motors and drives.

The system was designed specifically to meet the needs of automatic molding techniques for high-density powders, G-E engineers say. The plant is set up to minimize gas, thereby promoting faster cure and improved surface appearance of the finished plastic product.

G-E reports that safer working conditions have been effected through explosion-resistant electrical equipment, a general dust-collecting system at all points of manual operation, a pneumatic conveying system isolated with air locks, and grinding equipment designed with rupture disks to vent any excessive pressures developed internally.

Firestone Tubeless for Trucks

The line of tubeless truck tires and wheels with drop-center rims recently introduced by The Firestone Tire & Rubber Co., Akron, O., constitutes a fundamental change in mounting and design, the company says. A two-part tubeless tire assembly of tire and rim replaces the six-part conventional assembly of tire, tube, flap, rim base, flange, and locking ring, Firestone reports.

Five intermediate tire sizes have been eliminated from the company's line, with the eight remaining sizes ranging from 8-17.5 to 12-22.5. This resizing program will result in smaller storage inventories on the part of fleet owners and dealers, Firestone asserts.

Addition to Yale Plant

A new 9,000-square foot brick and steel adddition to the present plant of Yale Rubber Mfg. Co., Sandusky, Mich., has recently been completed. This addition will house new laboratories for quality control of manufacturing processes as well as new mills and extruders recently installed as part of an expanded extruded and spliced goods department.

Goodyear Anniversary At Rockmart Plant

A two-day program of festivities in observance of its twenty-fifth anniversary is reported to have taken place at Goodyear Tire & Rubber Co.'s textile mill at Rockmart, Ga., November 12 and 13. Events included an open-house party for the general public, as well as a parade, barbecue, and presentation of 25-year service pins to 15 workers at Clearwater Mill No. 2. This is the third such twenty-fifth anniversary celebration held by Goodyear employes in the South this year.

J. W. Snyder *(Right)*, Technical Director of Binney & Smith, Inc., Points out to J. M. Hamilton, the Firm's Vice President in Charge of Sales, Results of Road Tests Conducted on Truck Tires Compounded with Statex 125: (A) 42 Parts Statex 125 in 50/50 Nat./LTP GR-S Tread, Wear Rating 129%, Akron Turnpike; (B) Same Composition, Wear Rating 135%, Georgia

First Year for Hatco at New HQ

Hatco Chemical Co. has completed its first year at its new and larger headquarters located on 64 acres near Fords, N. J. The plant's facilities include three production buildings, outdoor reactors, storage tanks, and offices. Alcohols, glycols, acids, amines, esters, and ketones are manufactured.

The firm's plasticizers for the rubber industry are dibutyl phthalate (DBP), diisooctyl phthalate (DIOP), dioctyl phthalate (DOP), dicapryl phthalate (DCP), octyl decyl phthalate (ODP), didecyl phthalate (DDP), dibutyl sebacate (DBS), diisooctyl sebacate (DIOS), di-2-ethyl hexyl sebacate (DOS), dioctyl adipate (DOA), and didecyl adipate (DDA).

Other plasticizers include dimethyl phthalate for cellulose acetate molding, dibutoxyethyl adipate for vinyl butyral safety glass sheeting, dilauryl maleate for synthetic rubbers, and dibutyl fumarate for vinyl acetate. Several new products are now under development, according to the company.

Hatco Chemical Co.'s Plant near Fords, N. J.

Lectures on Accounting Statistical Quality Control

A three-day seminar on the application of statistical quality control to clerical and accounting procedures was conducted by William F. Buhl, senior procedure analyst for The B. F. Goodrich Co., Akron, O., at the ninth annual convention of the Systems & Procedures Association held in New York, N. Y., October 25-27.

Goodrich is said to be the first rubber company to install statistical quality control techniques in offices and one of the first to plan installations on a major scale.

According to Mr. Buhl, the statistical method saves time in work verification and reduces errors because of the control imposed upon them. Causes for error can be determined within a short time after their occurrence, permitting immediate action, he said.

Powerful Recoilless Rifle Developed by Firestone and Ordnance Corps

A 106-mm. recoilless rifle that gives the U. S. infantryman his most effective anti-tank weapon to date has been developed jointly by the Army Ordnance Corps at Frankford Arsenal, Philadelphia, Pa., and The Firestone Tire & Rubber Co., Akron, O.

Reported to have double the penetrating power and more than twice the effective range of any other anti-tank weapon, the 500-pound, 134-inch rifle fires 17½-pound projectiles after the target has been sought out and illuminated by 50-caliber tracer bullets. Dubbed BAT (Battalion Anti-Tank), it is operated by a crew of three, either from a Jeep or a ground-based tripod.

Three years in development, the weapon and the projectile were the end-result of what is termed a unique system of parallel research between industrial and Army engineers. When the project was completed, Firestone's ammunition and Frankford Arsenal's rifle were accepted by the Army.

J. L. Miller, manager of the defense research division for Firestone, and W. J. Kroeger, assistant director of the Frankford Arsenal laboratory, were the two men credited with major responsibility for the achievement and were honored for their work at the first public firing of the weapon at Erie Ordnance Depot, Lacarne, O.

The BAT is reported to have a striking power equal to that of the artillery's three-ton howitzer and has proved effective at extreme temperatures of heat and cold. The use of tracer bullets eliminates the need of a heavy but fragile optical range finder, conserving weight and increasing the durability of the rifle during the stress of combat.

Paul W. Litchfield *(Second, Right)*, Board Chairman of The Goodyear Tire & Rubber Co., Akron, O., Greets Ambassador Mukarto Notowidigdo of Indonesia at a Recent Dinner Given by Goodyear in Honor of the Ambassador and His Party. Looking on Are W. E. Klippert *(Left)*, Vice President of Goodyear Rubber Plantations Co., and Dr. Djuanda, Director of Indonesia's National Planning Bureau. Indonesia Produces a Large Part of the World's Rubber Supply

U. S. Rubber Sole Maker of Collapsible Containers

United States Rubber Co., New York, N. Y., developer of large collapsible rubber-fabric containers for shipping and storing flowable solids and liquids, is also the sole manufacturer of these containers; both the design and methods of construction are covered by patents. The Firestone Tire & Rubber Co., Akron, O., was inadvertently credited with being an additional manufacturer of these items in the September, 1954, issue of RUBBER WORLD (page 822).

Appraises Plastics Growth

Every man, woman, and child in the United States will consume at least 20 pounds of plastics this year, H. K. Intemann, vice president and general sales manager of Bakelite Co., division of Union Carbide & Carbon Corp., New York, N. Y., asserted before the Boston Conference on Distribution, October 19.

He put the total estimated production at three billion pounds, with about five billion dollars added to the national economy in goods and services. If plastics continue at their present rate of growth, he said, only steel, wood, and glass will exceed them in consumed volume by 1975.

Firestone Tubeless Production at One Million Monthly

Production of tubeless tires at the United States plants of The Firestone Tire & Rubber Co. has now reached the one-million-a-month mark, according to Lee R. Jackson, president, and the rate of output is expected to be considerably higher by early 1955. By the end of 1954, Firestone will have produced more than five million tubeless tires, he said.

He also revealed that extensive tests have shown that delays due to tire trouble are reduced more than 82% through the use of Firestone tubeless tires on taxicabs. A 75% reduction was in evidence in similar tests on trucks.

Another advantage of the tire, Mr. Jackson said, was its weight saving. A conventional tractor trailer 9.00-20 tire on its wheel weighs 196 pounds, while the same size tire on a drop-center wheel weighs approximately 168 pounds, a saving of 28 pounds. Two-hundred-eighty pounds would therefore be reduced from a tractor trailer equipped with 10 of the new tubeless tires, Mr. Jackson pointed out.

To Build New Neoprene Plant

Construction of a new neoprene plant at Montague, Mich., will begin in the spring, according to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. The facilities, consisting of a combination office building and laboratory, three manufacturing buildings, and several smaller structures, will adjoin the site of the Hooker Electrochemical Co.

The announcement follows up du Pont's purchase of an option on approximately 1,000 acres in the Montague area earlier this year. Design and construction will be conducted by the company's engineering department. The plant is scheduled for completion in late 1956 and will employ 250.

Hooker will supply the hydrogen chloride necessary for the process, and Union Carbide & Carbon Corp. will supply the needed acetylene from a plant it will build in the vicinity. Both materials will be piped in. Du Pont's present facilities for neoprene production are at Louisville, Ky., where an expansion project is currently nearing completion.

New Site for Spadone

Spadone Machine Co., Inc., recently moved its New York, N. Y., offices to South Norwalk, Conn. The new location on Connecticut Ave. provides additional office space, as well as quarters for special design and experimental work. Spadone-Alfa Corp., a subsidiary company devoted to the manufacture and sale of Metaline oilless bearings, will also have the same address.

Plaskon Agents Appointed

The Barrett Division of Allied Chemical & Dye Corp., New York, N. Y., has named Cary Co., Chicago, Ill., and The J. H. Hinz Co., Cleveland, O., as sales distributors for Plaskon coating resins. Cary will cover the Chicago area, and Hinz the north and central Ohio territory.

Nylon, Rayon Cord Competition Good, Straughn Says

The competition between nylon and rayon in the tire cord field will result in better tires for both passenger cars and trucks, W. D. R. Straughn, manager of the textile fibers department, rubber industry sales section, of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., told the thirty-fourth annual convention of the National Association of Independent Tire Dealers on October 27 in Chicago, Ill.

Du Pont competes with itself by selling both nylon and Super-Cordura high-tenacity rayon yarn to the rubber industry, he pointed out, adding, "But we feel it is important to develop and produce better products even though they compete with some of our other products."

Mr. Straughn recalled that rayon entered the tire cord picture in 1936 and saw general adoption in tire manufacturing by 1943. Nylon for tire cord came into use during World War II, he said, when makeshift runways demanded great resilience and impact resistance from aircraft tires, qualities which nylon fulfilled.

Recently perfected hot-stretching techniques have brought impressive expansion in the use of nylon by tire manufacturers, he said. Nylon's strength, bruise and impact resistance, moisture repellency, and heat resistance have made nylon cord tires the safest ever built, he concluded.

Court Ruling Favors Goodyear

The Common Pleas Court of Franklin County, Columbus, O., ruled recently that the Ohio Industrial Relations Department had gone beyond its authority in ordering The Goodyear Tire & Rubber Co. to make extensive mechanical alterations at the synthetic rubber plant it is operating for the federal government in Akron.

The State board had demanded the installation of safety devices which, Goodyear alleges, would have cost the federal government about $1,000,000. Federal inspectors disagreed with the Ohio officials, claiming that equipment at the plant was adequate to insure the safety of employes.

The dispute began in June, 1951, and primarily concerned the handling of liquefied petroleum gases. Workmen complained that ventilating and gas detection devices were inadequate, and a work stoppage occurred. While the case was pending, the plant received several citations for safety, according to Goodyear.

Employ Silicone Gasket

Gasketing made from SE-550 silicone rubber is being employed as the door seal for the U. S. Air Force's H-21 Work-Horse helicopter, according to General Electric Co., Waterford, N. Y. Extruded into P-strips, it affords a flexible seal in sub-tropical or Arctic temperatures and is resistant to ozone at high altitudes.

Owing to its ability to withstand temperatures as high as 500° F. and as low as minus 120° F., as well as its freedom from sticking at either extreme, SE-550 was selected by Pawling Rubber Corp., Pawling, N. Y., manufacturer of the door seals, for the Piasecki Helicopter Corp., Morton, Pa. The new gasket requires no replacement for practically the lifetime of the helicopter, irrespective of the weather conditions, GE asserts.

To Reopen Muscle Shoals Plant January 1

The Muscle Shoals chlorine and caustic soda plant, recently sold by the United States Government to Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, O., will be in production by January 1, 1955, John A. Sargent, president of the firm, told a gathering of civic and industrial leaders at Tuscumbia, Ala.

He revealed that the government originally asked the right to preempt the entire output of the plant for use by the adjoining Phosphate Development Works.

"During the course of our negotiations, however, the government substantially modified its position," he said. "Consequently, we are now in a position to guarantee commitments we make for supplies of chlorine and caustic soda out of Muscle Shoals."

Mr. Sargent added that it was reasonable to expect that customers in the area served by the plant would enjoy lower delivered costs on the products. He anticipated that 175 to 200 people would be employed when operations were ready to go into high gear.

Du Pont's Echols Resigns

Angus B. Echols has resigned from the board of directors of E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del., also relinquishing his posts as chairman of the finance committee, vice president in charge of finances, and member of the executive committee. Succeeding him as vice president and chairman of the finance committee is Lammot du Pont Copeland, secretary of the company and member of the finance committee.

Other announced changes in the organization include the election of T. Crawley Davis to membership in the finance committee, and the election of Robert L. Richards, general manager of the textile fibers department, to the position of director, vice president, and member of the executive committee.

Mr. Echols, 65, who joined du Pont in 1912 as an engineer and became treasurer in 1926, was given credit for playing "a major and invaluable role in the formulation and direction of the financial policies of this company duirng the period of its greatest growth," according to a statement issued by the board of directors.

Award to Firestone

A plaque was awarded Firestone Tire & Rubber Co., Akron, O., for special service to motor truck transportation at a luncheon given by the American Trucking Association Foundation at the Waldorf Astoria Hotel, New York, N. Y., October 28. Presentation was made by Walter F. Carey, chairman of the association foundation. H. D. Tompkins, vice president of Firestone, accepted on behalf of the firm.

Names Oregon Distributor

New York Belting & Packing Co., Passaic, N. J., has appointed Woodbury & Co., Portland, Oreg., to handle sales of rubber hose, belting, "timing" belt drives, and other industrial rubber products, for the State of Oregon.

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New Plastic Foam by General Tire

A new self-curing plastic foam material said to be particularly valuable in lightweight product applications such as furniture, shoe soles, and cushioning has been introduced by The General Tire & Rubber Co., Akron, O.

The foam is produced by blending a polyester resin, a diisocyanate, and a catalyst, according to the company. The mixture is allowed to flow at room temperature into a mold where chemical action releases the foaming gas, and the material cures simultaneously. The process has been licensed to the company and is produced at its Marion, Ind., plant.

Qualities claimed for this foam are high tensile strength, tear resistance, excellent compressibility, long flex life, and resistance to heat, flame, sunlight, oils, chemicals, and dry-cleaning solvents. The interconnecting cells of this plastic foam are said to make it useful as an air filter.

Form New Firm to Build Conveyor-Belt Shuttle

Passenger Belt Conveyors, Inc., Akron, O., a new company jointly organized by The Goodyear Tire & Rubber Co., Akron, and Stephens-Adamson Mfg. Co., Aurora, Ill., has been contracted to build New York's long-discussed conveyor-belt train that will replace the old shuttle between Times Square and Grand Central, the city's Transit Authority has revealed.

The proposed conveyor system will consist of 130 ten-passenger cars constantly in motion and will take two years to construct. Passenger Belt Conveyors, Inc., the only bidder on the project, will design, furnish, and install the cars and equipment at a cost to the city of $3,881,000.

Before incorporation, the parent companies worked jointly on similar enterprises for more than five years.

President of the new firm is Sam DuPree, of Goodyear, and vice president is D. L. Stephens, of Stephens-Adamson. Other directors and officials will be drawn from both companies.

Tenite Polyethylene Marketed

Marketing of Tenite Polyethylene, a molding and extrusion plastic manufactured by Texas Eastman Co., Longview, Tex., has been announced by Eastman Chemical Products, Inc., Kingsport, Tenn. The plastic, distributed as spherical pellets, is said to be the first new source of polyethylene material in more than 10 years. Both companies are subsidiaries of Eastman Kodak Co., Rochester, N. Y.

The purpose of the spherical pellet form is to produce uniform flowing of the substance from the hopper into the heating cylinder of the molding or extrusion machine, according to the company. Ease of keeping the plastic clean, facility of storing and reduction of storage space, and ease of cleaning the hopper of the machine when color is being changed, are cited as other advantages of the spherical shape.

Produced under a licensing arrangement with Imperial Chemical Industries, Ltd., the basic raw material for Tenite Polyethylene is propane, Eastman Chemical Products reports. The Longview plant has a production capacity of 20 million pounds annually.

James C. Heintz

Walter P. Voth

Buys Interest in Heintz Firm

Akron Standard Mold Co., Akron, O., 36-year-old manufacturer of tire molds and tire-making equipment, has purchased an interest in James C. Heintz & Co., Inc., Cleveland, O., according to Walter P. Voth, president of the Akron firm, who cited the Heintz Monotread casting methods and foundry as being of particular interest to his organization.

"Heintz and one other company stand in a class by themselves when it comes to producing intricate fine-quality molds in short order," Mr. Voth said, adding that customers of both companies will stand to benefit from the new pooling of interests.

Explaining the importance of the Heintz techniques in producing silent non-skid tread designs, intricate patterns of groove pitch that vary from rib to rib, he said that even the most complicated and demanding specifications can thereby be produced from master to completed mold within seven days.

Mr. Voth said that while he will assume the position of vice president of the Heintz firm, no other changes in direction are expected. James C. Heintz will remain president; Charles Smith will continue as sales manager; and other executives will maintain their present status.

Du Pont Expanding Isocyanate Facilities

Plans to construct additional facilities for the manufacture of polyisocyanates at its Deepwater, N. J., plant have been announced by E. I. du Pont de Nemours & Co., Inc. J. C. Lang, the plant's field project manager, will supervise design and construction, with completion of facilities scheduled for mid-1956.

According to du Pont, the use of isocyanates in polymer chemistry stems from the same fundamental research program of the 1930's that produced nylon and neoprene, and, as a result, the company now holds many basic patents in this field. The company reports, however, that its primary interest will be limited to the supplying of isocyanates as raw material for other manufacturers, and it will not engage in the production of end-products.

Polyisocyanates were first put to commercial use in the manufacture of special elastomer-based adhesives for cementing fabrics to rubber, du Pont says. Resilient polyuréthane foams that offer many advantages over ordinary foam rubber have also been made. Among new product possibilities, du Pont names urethane rubber and semi-rigid and rigid foamed structural materials.

Lobl Mfg. Co. Bought by Faultless Rubber

The Faultless Rubber Co., Ashland, O., has purchased Lobl Mfg. Co., Middleboro, Mass., manufacturer of ice bags, heating pads, and rubberized fabric items. Lobl employs 100 persons and will be operated as a separate organization under its own name.

Faultless produces molded, extruded, and dipped rubber and foam latex products for the drug, surgical, and industrial fields.

Names Canadian Manufacturer

Spadone Machine Co., Inc., South Norwalk, Conn., has named Francis Shaw, Ltd., Burlington, Ont., Canada, manufacturer for its entire line of Spring Leaf Trucks in Canada. Sales will be handled by Spadone.

Masking Finish for Mat Prints

A new finish that eliminates fiber-glass mat prints from reinforced plastics products has been announced by Lunn Laminates, Inc., New York, N. Y. Called Lunn Finish #107, the material has a cellulose base and is applied as part of the original lay-up. Previously performed buffing, sanding, and painting are done away with, the company says, with a resulting economy of time and cost.

The finish is soft and flexible enough to follow contour in molding and is thoroughly permeable to pigments and filters, according to Lunn. It is also said to increase the abrasion resistance of the finished product and, being smooth, makes for easier cleaning. Primarily developed for matched metal molding, it can also be used for bag molding.

Among the uses suggesed for the finish are in such molded goods as vending machines, cases, office machinery housings, baby carriages, and automotive and boating assemblies.

Names New Agents

An expanded sales and production program has been announced by Synthetic Products Co., Cleveland, O., with the appointment of new sales representatives in Canada, California, and Florida. The company's metallic stearates and vinyl heat and light stabilizers, marketed under the trade names Synpro and Synpron, will be distributed by H. L. M. Royal Co., Los Angeles, Calif.; Binney & Smith, Ltd., Toronto, Ont., Canada; and Palmer Supply Co., Florida.

Wheeler-Crouch Merger

William S. Wheeler, president and board chairman of Wheeler Associates, Inc., Cleveland, O., has announced that R. Pat Crouch, president of Crouch Associates of Cleveland, has affiliated his organization with Wheeler Associates. Mr. Crouch will head the operations research department in the new grouping. Wheeler Associates are industrial and management consultants.

Install 1,500-Foot Tenite Pipe

A 1,500-foot, four-inch Tenite butyrate plastic pipe was recently installed at the International Harvester Co.'s sisal plantation at Cardenas, Cuba, to conduct high-acid bagasse water waste from a decorticator plant to a disposal pit. The pipeline, running underground, replaces a wooden pipe system that had been degenerated by the corrosive liquid.

The pipe was extruded by Triangle Conduit & Cable Co., Inc., New Brunswick, N. J., from Tenite butyrate supplied to it by Eastman Chemical Products, Inc., Kingsport, Tenn. Tenite pipe is widely used in oil fields for transporting sour crudes and salt water.

Resin for Pipe Repair

The use of Celanese polyester resin in the repair of 40 feet of corroded header pipe has been reported by Celanese Corp. of America, New York, N. Y. The pipe, at the firm's Bishop, Tex., plant, was rusted paper thin and had large holes in some areas. Thirty gallons of resin were used for the repair, according to the company.

Two plies of glass cloth, saturated with a self-curing blend of Celanese MR-28C Resin, were applied over the large holes, Celanese says. Leaks were then plugged, and two additional plies of glass cloth, saturated with resin, were wrapped about the entire rusted area of the pipe.

New Dow Market Research Group

Formation of a research development section within the market research department was announced by Dow Chemical Co., Midland, Mich., for the purpose of forecasting long-range trends by the analysis of specific industrial fields. The information will be passed on to Dow research and development groups as a means of evolving and exchanging new ideas.

E. R. Boedeker will head the unit's activities in the petroleum industry, and T. E. Werkema in the construction industry.

OBITUARY

Thomas W. Casey

Thomas W. Casey

Thomas W. Casey, vice president in charge of the rubber division of Acushnet Process Co., New Bedford, Mass., died in his sleep November 10 of a heart attack at his home in Fairhaven, Mass.

He was born in Pawnee City, Neb., 62 years ago. The deceased was a graduate of Kent School of Law in Chicago and was also a U. S. Army veteran of World War I.

Associated with Acushnet since 1940, he had previously served with The B. F. Goodrich Co. (1919-27), Faultless Rubber Co. (1927-28), and Seiberling Latex Products Co. (1928-40).

Mr. Casey was prominent in civic and political activties in the Greater New Bedford area. He also belonged to the Masons.

Surviving are his wife, a son, a stepdaughter, two brothers, and two sisters.

A memorial service was held in the Fairhaven Unitarian Church on November 12. Mr. Casey was buried in Ashland, O.

Vaughn Y. Bell

Vaughn Y. Bell, 59, manager of fleet sales and service for Goodyear Tire & Rubber Co., Akron, O., died October 28 in New York, N. Y., after a three-day illness.

Associated with Goodyear for more than 30 years, he was widely known throughout the trucking industry and was an active member of the American Trucking Association.

Born in New Castle, Pa., the deceased started with Goodyear as a salesman in Kankakee, Ill. During World War II he was associated with United China Relief.

He leaves a wife and a son.

The body was returned to Akron for burial.

Robert D. Abbott

Robert Duane Abbott, president of R. D. Abbott Co., Inc., Los Angeles, Calif., died November 9 at the Covina Community Hospital, Covina, Calif.

He was born in Akron, O., July 4, 1892.

He joined Miller Rubber Co., Akron, upon his graduation from Cornell University in 1917. In 1932 he became associated with C. P. Hall Co. and remained as vice president-general manager until 1948. Then he established R. D. Abbott Co., Inc., consulting chemist and manufacturers representative.

The deceased served as a Chief Petty Officer in the U. S. Naval Flying Corp. during the first World War. Mr. Abbott was also past president of Cornell Club of California, secretary of the Southern California Section of the American Chemical Society, and past chairman of The Los Angeles Rubber Group. He had currently held the office of chairman of the Tlargi-University of Southern California Rubber Technology Foundation and was on the Tlargi Educational Committee.

He is survived by his wife and a son.

John H. Kelly

John H. Kelly, product manager, footwear division, of Tyer Rubber Co., Andover, Mass., died at his home in Andover on October 19 of a heart ailment.

He was born on April 27, 1889. He attended Boston English High School, Chauncy Hall School, and the American School of Correspondence.

After having been successively associated with Granby Consolidated Mines, Mishawaka Woolen Mfg. Co., Converse Rubber Shoe Co., and Firestone Tire & Rubber Co., he joined Tyer in 1935 as assistant sales manager.

The deceased served on the Andover board of public works during 1946-52. He also belonged to several fraternal groups.

Requiem Mass was said in St. Augustine's Church, Andover, October 22, followed by burial in Holyhood Cemetery, Brookline, Mass.

Mr. Kelly is survived by his wife, three sons, a daughter, and three grandchildren.

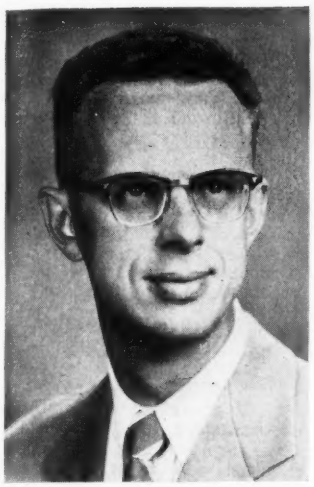
Rigid Vinyl

(*Continued from page 381*)

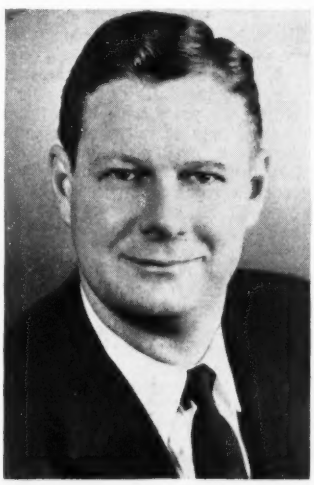
vinyl thermoplastic structural plastic industry was first given impetus by Goodrich Chemical's introduction in 1951 of a polymer based on polyvinyl chloride resin which could be processed on conventional equipment, according to Mr. Parks. The material, which did not have high impact strength, gave way a year later to a vinyl plastic developed by the company which had greater rigidity and strength. It proved valuable in handling such corrosive materials as salt, vinegar, alum, caustic, and water which present serious handling difficulties in long-range terms.

The extrusion of pipe was relatively simple, he continued, but the molding of fittings was more difficult since unplasticized polyvinyl chloride resins decompose without melting. Transfer molding the hot plastic off the mill or from the extruder proved to be the solution. High-quality molded fittings with molded threads or smooth surfaces for cementing are today being made in standard sizes through two inches, he said.

NEWS ABOUT PEOPLE



John H. Gifford



Robert B. Sucher

Ernest A. Doerschuk, since 1947 assistant treasurer of The B. F. Goodrich Co., Akron, O., and for 19 years previously general credit manager, retires December 1 after more than 38 years of service.

Frederick W. Moyer has been appointed assistant treasurer to Mr. Doerschuk. Mr. Moyer received a B.S. degree in business administration, M.S. degree in economics, and a Ph.D. degree in money and banking, from Ohio State University. He joined the company in 1951 as an economist after a number of years' experience in the field of economic research, including a tenure as secretary to the president of Capital Finance Co.

Frank W. Milward has been named special sales representative to the Chicago area for the chemical division of The Goodyear Tire & Rubber Co., Akron, O.

John H. Gifford has been named technical director, carbon black division, and **Robert B. Sucher** has been appointed assistant sales manager, rubber chemical products promotion, of Witco-Continental, Akron, O. Mr. Gifford was previously associated with The B. F. Goodrich Co. Mr. Sucher had been affiliated with Marbon Corp. and Inland Mfg. Co.

Edmund G. Nagle has been appointed sales manager for the footwear and general products division of United States Rubber Co., New York, N. Y. This division includes all types of foam rubber, automotive mats, Royalite plastics, and sponge products. Mr. Nagle will make the Mishawaka, Ind., plant his headquarters.

George E. Manser, Jr., sales manager for the firm's automotive coated fabrics, will take on the additional function of Detroit regional sales manager.

William Hagel has been appointed vice president and executive assistant of United Engineering & Foundry Co., Pittsburgh, Pa. Also named was **Clark H. Johnson,** who assumes the position of vice president in charge of sales.

J. G. Detwiler has been appointed to the staff of Foster D. Snell, Inc., 29 W. 15th St., New York 11, N. Y., as a chemical consultant to the petroleum industry. He formerly served as chemist for Lackawanna Steel Co. and Texas Co.

Egon I. Sudy has been named technical representative for the company in Argentina, Brazil, Chile, and Uruguay. Dr. Sudy had previously been chief chemist and deputy manager of the Paris subsidiary of Warner-Hudnut.

Howard L. Minckler has been appointed plant manager for the organic chemicals division, Monsanto Chemical Co., Avon, Calif. He replaces **Donald J. Miller,** who has been named plant manager for Mohay Chemical Co., Martinsville, W. Va. Mr. Minckler joined Monsanto in 1941, serving the company as chemist and supervisor of the plastics division. Mr. Miller became manager of the Avon plant in 1952.

Gerald D. Griffin has been named district sales manager for the southern states region of Alsynite Co. of America, San Diego, Calif. Also appointed were **Will Thomas,** as district manager for the New York and New England areas; **Harold J. McDonnell,** as Canadian representative; and **Richard J. Miller** as district representative for southern California and Arizona.

Lawrence C. Houdek has been promoted to division engineer of the adhesives and coatings division of Minnesota Mining & Mfg. Co., St. Paul, Minn. He formerly served the company in the abrasives laboratory, as field engineer, and as assistant division engineer.

Bob Stringfield is now vice president of Fullerton Mfg. Co., Fullerton, Calif.

W. C. Davis has been appointed Detroit district manager for Pennsylvania Industrial Chemical Corp., Clairton, Pa. He was formerly associated with Monsanto Chemical Co. and American Cyanamid Co.

William Hagel

Clark H. Johnson

W. C. Davis

Earl Hensel has been promoted to superintendent of the tire plant of the tire and equipment division, The B. F. Goodrich Co., Akron, O. He has been with the firm since 1933, serving in various production capacities in Oaks, Pa., Los Angeles, Calif., and Ontario, Canada.

Louis A. Fisher, president, and **J. N. Tincknell,** treasurer, of Fabricon Products, Inc., River Rouge, Mich., were elected vice president and assistant secretary, respectively, of The Eagle-Picher Co., Cincinnati, O.

Paul A. Koons has been assigned as sales representative to the Cleveland area by the chemical division of The Goodyear Tire & Rubber Co., Akron, O. **Joseph M. Donohue** was assigned to the Boston district office.

William F. Amon, Jr., has been named assistant manager of product development for the research and engineering division of Monsanto Chemical Co., St. Louis, Mo. He was formerly with Minnesota Mining & Mfg. Co.

Robert J. Patrick has been appointed tire sales manager of the Dunlop Tire & Rubber Corp., Buffalo, N. Y. He formerly served the company as truck tire sales manager and before that had been truck sales manager for Dayton Rubber Co. In his present capacity Mr. Patrick will direct the entire replacement tire sales program.

Ted R. Carrell has been named Pacific Coast O-ring sales engineer for The Parker Appliance Co., Cleveland, O. He formerly was associated with North American Aviation Co., and E. B. Wiggins Co.

Breckinridge K. Tremaine has joined Rhodia, Inc., New York, N. Y., as technical director of its industrial "Alamask" reodorant division. He started his career with the organic chemical department of E. I. du Pont de Nemours & Co., Inc., as chemist and technical representative.

Fred J. Wehmer has been named commercial development manager of the adhesives and coatings division of Minnesota Mining & Mfg. Co., St. Paul, Minn. In his new position Mr. Wehmer will be responsible for the adhesives and coatings technical service laboratories and field service departments. He formerly served the company as chief chemist, technical director, and chemical engineer in the tape division.

R. R. Meltz has been appointed manager of the roll covering department for Quaker Rubber Corp., division of H. K. Porter Co., Inc., Philadelphia, Pa. He will be responsible for coordinating the activities of factory and field personnel in the sales and service departments.

Victor di Lustro has been named general mill manager, and **C. F. Randall** manager of production planning, of Anaconda Wire & Cable Co., Hastings-on-Hudson, N. Y. Both men have been associated with the company since 1929.

Anaconda Wire & Cable Co., New York, N. Y., has announced the following changes among members of the sales department:

H. V. Van Valkenburg as sales manager, with headquarters in New York, N. Y. He was formerly Chicago regional sales manager.

C. B. Peck, Jr., as manager of industrial sales. Mr. Peck had served as sales manager for the rubber and plastic insulation division.

J. L. Tindale as manager of utility sales. Mr. Tindale had been sales manager for bare and weatherproof power cable and accessories.

H. E. West as manager of contractor sales. Formerly Mr. West had been manager of industrial promotions.

A. W. Koch continues as manager of magnet wire sales.

D. Saunders Threlkeld has been appointed manager of the research and control laboratories for The Clopay Corp., Cincinnati, O. He replaces **Phillip H. Rhodes,** who recently left Clopay to enter the consulting field. Mr. Threlkeld formerly served with the chemical research laboratories of The National Cash Register Co., Wright Field Material Command, and with the materials laboratory of the Kentucky Department of Highways as a materials engineer.

Frank E. Seborowsky, David M. Bartlett, Gerald J. Monaghan, and **Fred H. Branstetter** have been added to the sales department of the plastics division of Celanese Corp. of America, New York, N. Y. Other recent additions are **Paul K. Riske,** technical sales service department, and **James J. Begley,** market development department.

Herman F. Mark, director of the Institute of Polymer Research at Polytechnic Institute of Brooklyn, has been elected chairman of the American Chemical Society's Division of Polymer Chemistry for 1955. He succeeds **Raymond M. Fuoss,** Yale University. Chairman-elect is **Raymond F. Boyer,** Dow Chemical Co.

David E. Allen has been appointed vice president in charge of sales, and **Charles H. Porter** and **Maurice J. McCarthy** have been named commercial vice presidents, of Anaconda Wire & Cable Co., New York, N. Y. Mr. Allen replaces **L. R. Love,** who will remain vice president in an advisory capacity.

Edwin L. Gustus, vice president of Bjorksten Research Laboratories, Inc., Madison, Wis., left recently on his annual visit to European clients. Dr. Gustus will also gather data on recent progress in scientific industrial research in Western European countries.

Glenn E. King has been appointed director of research of Yale Rubber Mfg. Co., Sandusky, Mich. **Edward Bielski,** previously general foreman, has been named production manager.

Robert L. Berra has been named director of sales training for the plastics division of Monsanto Chemical Co., Springfield, Mass. He previously served the company as employe relations manager.

Matthew J. Delehaunty has been promoted to manager of mechanical goods sales for the mechanical goods division of United States Rubber Co., New York, N. Y. Formerly manager of commodity sales, he will direct marketing of hose and multiflex ducts, packing, flooring, conveyor and elevator belting, power transmission belting, molded and extruded goods, and tape. He will make his headquarters at the company's Passaic, N. J., plant.

Harry C. Allen, Jr., has been appointed to the staff of the National Bureau of Standards to conduct research in molecular spectroscopy and interpretation of vibrational-rotational spectra. Dr. Allen, formerly assistant professor of physics at Michigan State College, acted as consultant to the Bureau in the past.

E. Burke Neff has been elected vice president and general manager of Minnesota Silicone Rubber, Inc., St. Louis Park, Minn. The firm specializes in precision molded silicone rubber parts used as insulators and component parts of electronic and aircraft equipment. It is affiliated with Minnesota Rubber & Gasket Co., also of St. Louis Park.

William K. Wilder has been promoted to superintendent of Goodyear Tire & Rubber Co.'s Decatur Mills, Decatur, Ala., replacing **Charles W. Young,** who has retired after 32 years with the firm. Mr. Wilder previously served the company as textile engineer, master mechanic, and assistant superintendent. Mr. Young had superintended various Goodyear mills since 1922.

George L. Royer has been appointed administrative assistant to the general manager of the research division of American Cyanamid Co., New York, N. Y. Dr. Royer will coordinate budget, personnel, and publication policies at the division's laboratories in Stamford, Conn., Pearl River, N. Y., and Bound Brook, N. J.

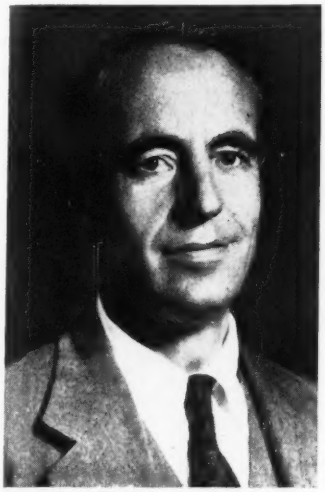
Tom J. Cain, Jr., director of safety, The B. F. Goodrich Co., Akron, O., was named general chairman of the Rubber Section of the National Safety Council at the Forty-Second National Safety Congress in Chicago, Ill. He succeeds **R. W. Fickes,** Goodyear Tire & Rubber Co., Akron, O.

E. W. Falk has been appointed commercial engineer for Mycalex Corp. of America, Clifton, N. J. For the past 25 years he was a plastics sales engineer for General Electric Co. and previously had been associated with Monowatt Corp.

Bob Youmans has become assistant chemist at Kirkhill Rubber Co., Los Angeles, Calif. He was formerly with R. T. Vanderbilt Co.

Jean R. Okel has been promoted to manager of project evaluation for the development department of the research and engineering division, Monsanto Chemical Co., St. Louis, Mo. He previously had served the company as engineering manager for the western section of Monsanto's organic chemicals division.

Phillip E. McIntyre has been appointed manager of the rubber chemicals section of the organic chemicals division of Monsanto Chemical Co., Nitro, W. Va.



White Star I.P.S.

Thomas D. Cabot

Thomas D. Cabot, president of Godfrey L. Cabot, Inc., Boston, Mass., was reelected to the National Industrial Conference Board for a term of one year at the Board's October meeting at the Ambassador Hotel, New York, N. Y. Formerly director for international security affairs in the office of the United States Department of State, Mr. Cabot has been a board member since 1946.

G. Allen Lovell has been promoted to assistant general manager of the mechanical goods division, United States Rubber Co., New York, N. Y. He replaces **Herbert G. Kieswetter,** who has been named executive assistant to the general manager of the company's international division. Mr. Lovell will supervise production and research as well as sales operations in the mechanical goods division, with headquarters in New York. Mr. Kieswetter will supervise activities of the international division in Great Britain and Europe.

George Hunsinger has been appointed cable engineer of Western Insulated Wire Co., Los Angeles, Calif.

A. R. Brandt has been elected a member of the board of directors and vice president in charge of manufacturing at Bond International, Inc., rubber products division, Detroit, Mich. **Walter S. Meyers,** formerly vice president of the company, has been elected executive vice president. Also named was **Raymond Smith,** now temporarily assistant to the president.

A. R. Brandt

Wesley S. Coe has been appointed assistant to John E. Caskey, vice president and general manager of the Naugatuck Chemical division, United States Rubber Co., New York, N. Y. Dr. Coe was formerly assistant factory manager of the chemical and synthetic rubber plants operated by the division in Naugatuck, Conn.

Also named was **J. Nelson Judy** as assistant to the factory manager at Naugatuck.

Harold Gordon was advanced to vice president in charge of production for Martin Rubber Co., Inc., Long Branch, N. J. He has been associated with the company since 1938.

A. S. Bishop has been named managing director of the Goodyear Tire & Rubber Co. of Great Britain, Ltd., succeeding **W. A. Hazlett,** who has retired after 48 years' service and will return to Akron, O., as vice president in charge of special assignments for Goodyear Tire & Rubber Co., Inc. Mr. Bishop formerly served the company as sales director for the Goodyear subsidiary in Great Britain. **H. L. Ginaven,** plant manager of British Goodyear, has been appointed director of production, becoming also a member of the company's board of directors. **W. S. Meyer,** former manager of the Near East and African divisions, succeeds Mr. Bishop as sales director. **A. H. Pendree** has been named general sales manager.

Edward J. Goett has been elected a director and vice president for the Darco and commercial development departments of Atlas Powder Co., Wilmington, Del. Mr. Goett formerly has served as a director and sales development director for Chas. Pfizer & Co.

W. Clayton Lytle has been named general manager of the Atlas chemicals department, succeeding **Kenneth E. Mulford,** who was appointed assistant to Mr. Goett.

J. N. Mager has been appointed manager of roll sales at United Engineering & Foundry Co., Pittsburgh, Pa., succeeding **Horace Mager,** who retires December 31 after 31 years with the company, most recently as vice president in charge of roll sales and steel castings. J. N. Mager has been associated with the roll and steel castings sales department of the company for the past 12 years.

Dick Peterson has been appointed sales manager of Interstate Rubber Products Corp. and West Coast Tire Co., Los Angeles, Calif., replacing **Les Lyons,** who has organized his own business venture.

Roger A. Calsibet has been named manager of the surface coating materials division, Bakelite Co., a division of Union Carbide & Carbon Corp., New York, N. Y. He succeeds **C. W. Patton,** who now is responsible for the sales of all Bakelite's materials for coatings and vinyl products for adhesives.

Wesley S. Coe

Harold Gordon

Roger A. Calsibet

Carl J. Minnig, having reached the company's retirement age, has retired as vice president of Witco Chemical Co., New York, N. Y. He will be retained, however, as a consultant to the rubber industry and will maintain headquarters at the Akron office. Mr. Minnig has served Witco-Continental interests throughout the United States since 1937.

R. W. Richardson has been appointed vice president in charge of sales for Goodyear Aircraft Corp., Akron, O. He formerly served as manager for the north central division of Goodyear Tire & Rubber Co. at Chicago. **L. W. C. Dye,** who previously headed Goodyear's Chicago district, replaces Mr. Richardson.

Lloyd J. Falkenhagen has resigned as vice president in charge of operations of Stokes Division, The General Tire & Rubber Co. of Canada, Ltd., Welland, Ont. Terminating a 29-year association with Stokes, Mr. Falkenhagen will now devote himself to developing new business enterprises.

James E. Sayre has been promoted to manager of the market research department for Barrett Division, Allied Chemical & Dye Corp., New York, N. Y.

Dominick Rosato has been appointed field engineer in charge of developing asbestos-based laminates for Raybestos-Manhattan, Inc., United States Asbestos Division, Manheim, Pa. He was formerly chief of the plastics productions section at Wright-Patterson Air Force Base, Dayton, O.

Phillip A. Sanguinetti and **Herbert L. Heiss** have been appointed group leaders in the research department of Mobay Chemical Co., St. Louis, Mo. Mr. Sanguinetti will head the company's product and equipment group; while Mr. Heiss will be in charge of investigating the application of isocyanates in the coating, rubber, and adhesives fields.

Leonard M. Freeman has been named manager of quality control for The B. F. Goodrich Co. Tire & Equipment Division, Akron, O. Mr. Freeman, with the firm since 1926, will be responsible for coordinating and unifying quality control methods and procedures for all tire manufacturing.

Carl W. Patton has been named general manager of advertising and public relations for Bakelite Co., division of Union Carbide & Carbon Corp., New York, N. Y. Manager of the company's surface coating materials sales for the past nine years, he first became associated with Union Carbide in 1932 as a plastics research chemist.

F. C. Peterson has been appointed director of industrial relations for Dow Chemical Co., Midland, Mich., replacing **Luther Evans,** who will become assistant general manager of the firm's Texas division. Joining Dow in 1938 as a research chemist, Dr. Peterson successively served as director of research and development, assistant manager, and manager of the cellulose products division. Mr. Evans became associated with the company in 1936 as a chemist.

MEXICO

Industry Growth Includes New Firestone Plant

The rubber industry is making new advances in Mexico, as is indicated by the considerably increased imports of crude rubber in the early part of 1954, as well as by some recent developments. Whereas in the first quarter of 1953, crude rubber imports amounted to 2,842 tons, valued at 13,500,000 pesos, the figures for the first quarter of 1954 were 4,104 tons, value 16,000,000 pesos.

It is learned that the Firestone Tire & Rubber Co. has requested and received permission from the Secretary of National Economy to establish in Mexico a factory for manufacturing tires and other rubber goods. At present the firm is represented here by Llantas y Artefactos de Hule, S.A.

Sellomaticas, tubeless tires, have been made and sold here for more than two years by the Euzkadie concern, which is understood now to be contemplating the production also of a cheaper brand of tubeless tire (not Sellomatica). This company recently set up a service station for supplying tire users with specialized technical information on tire problems and advice on how to get the most out of their tires.

Rayon tire cord is now to be made locally. Celanese Mexicana S.A. is said to have installed special equipment in its factory at Zaccapu, Michoacan, for producing high-tension 1,680 denier rayon, which will be worked into tire cord at the Toluca plant. Hitherto rayon tire cord has been imported, chiefly from the United States and Canada. Celanese Mexicana expects to cover 25% of local needs to begin with and 50% in 1955.

German Machinery Available

German machinery for rubber and plastics is now directly available to Mexican manufacturers, a recent report indicates. A local firm has obtained the representation of several important German concerns, including Braun-Angott, Becker & von Huellen, A. Reifenhauser, and Gottlieb Wiedmann.

Mexico has just acquired its first radiation gage for use in controlling the thickness and weight of rubberized nylon and rayon tire cord. The radiation gage, which employs the beta rays of Strontium 90, is part of the huge installation set up for processing cord in the up-to-date plant of Cia. Hulera Euzkadi, S.A., which manufactures Goodrich-Euzkadi products.

Oscar C. Zaske, Frank P. Avonda, and **Donald H. Campbell** have been added to the research and development department of Hooker Electrochemical Co., Niagara Falls, N. Y.

S. W. Jones, Jr., has been appointed administrative manager to sales of the chemical manufacturing division of M. W. Kellogg Co., subsidiary of Pullman Inc., New York, N. Y. Prior to joining Kellogg in 1950, he had been associated with Celluloid Corp. and with *Modern Plastics* and *Modern Packaging* magazines.

FINANCIAL

Allied Chemical & Dye Corp., New York, N. Y. Nine months ended September 30, 1954: net profit, $31,915,511, equal to $3.57 each on 8,940,026 capital shares, compared with $33,738,809, or $3.81 each on 8,856,469 shares, in the previous year's months; sales, $399,414,436, against $411,295,748.

American Zinc, Lead & Smelting Co., Columbus, O. Year ended September 30, 1954: net income, $1,579,906, equal to $1.84 a common share, against $1,687,420, or $2.00 a share, in the preceding fiscal year.

Anaconda Wire & Cable Co., New York, N. Y. Fist nine months, 1954: net earnings, $3,461,714, equal to $4.10 a common share, compared with $4,992,825, or $5.92 a share, a year earlier.

Belden Mfg. Co., Chicago, Ill. Nine months to September 30, 1954: net profit, $679,123, equal to $2.12 a share, compared with $1,040,710, or $3.24 a share, a year earlier.

Blaw-Knox Co., Pittsburgh, Pa. January 1-September 30, 1954: consolidated net income, $3,141,142, equal to $2.07 each on 1,519,255 capital shares, compared with $3,056,927, or $2.17 each on 1,411,468 shares, a year earlier; sales, $82,372,511, against $91,493,850.

Borg-Warner Corp., Chicago, Ill., and subsidiaries. Nine months to September 30, 1954: net income, $14,052,304, equal to $5.68 each on 2,403,586 common shares, compared with $17,020,364, or $6.93 each on 2,396,289 shares, in the same months of the preceding year; net sales, $281,706,159, against $314,977,495.

Brunswick-Balke-Collender Co., Chicago, Ill. First three quarters, 1954: net income, $427,555, equal to 75¢ a share, contrasted with $157,238, or 15¢ a share, in the same period of 1953.

Carborundum Co., Niagara Falls, N. Y. January 1-September 30, 1954: net income, $2,419,366, equal to $1.41 a share, contrasted with $4,744,416, or $3.06 a share, in the corresponding months of 1953.

Philip Carey Mfg. Co., Cincinnati, O. Nine months ended Septembe 30, 1954: net earnings, $1,822,883, equal to $2.20 a share, against $1,853,118, or $2.24 a share, in the 1953 period.

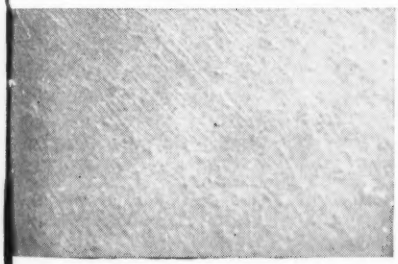
Circle Wire & Cable Corp., Maspeth, L. I., N. Y. First nine months, 1954: net earnings, $753,017, equal to $1.01 a share, contrasted with $1,574,263, or $2.10 a share, in the first nine months of 1953.

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., and wholly owned subsidiaries. First nine months, 1954: net earnings, $223,797,063, equal to $4.74 each on 45,449,305 common shares, compared with $172,829,089, or $3.62 each on 45,553,686 shares, a year earlier; sales, $1,247,502,068, against $1,346,282,314.

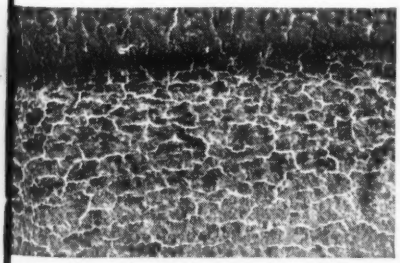
No sign of checking. The rubber insulation on this wire contains Sunoco Anti-Chek. Compare it with the sample at the right.

Surface checking is clearly evident in the rubber covering of this wire—which does not contain Sunoco Anti-Chek.

STOP SURFACE CHECKING AND CRACKING WITH SUNOCO ANTI-CHEK



Sunoco Anti-Chek keeps black sidewalls smooth... even after prolonged storage.



Notice the cracking and checking of the sidewall on this tire which does not contain Sunoco Anti-Chek.

Sunoco Anti-Chek is unique . . . there's no other anti-checking wax like it. It's a narrow-cut primary product, not a blend. It is completely controlled from crude oil to finished product by the same company that originally developed it. And it is made in the most flexible wax plant in the world. To you this means a completely uniform product that can be depended on for the same excellent results tomorrow, next year, 10 years from now!

Detailed information on the many advantages of Sunoco Anti-Chek is given in a new technical bulletin. To get a copy, call your Sun Oil Company representative or write Dept. RW-12.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

SUNOCO®

PHILADELPHIA 3, PA. • SUN OIL COMPANY LTD., TORONTO & MONTREAL

Refiners of famous High-Test Blue Sunoco Gasoline

Columbian Carbon Co., New York, N. Y. Nine months ended September 30, 1954: net income, $3,256,068, equal to $2.02 a share, against $3,376,537, or $2.09 a share, a year earlier.

Cooper Tire & Rubber Co., Findlay, O. Nine months to September 30, 1954: net earnings, $60,786, equal to 39¢ a share, contrasted with $415,211, or $2.65 a share, in the 1953 months.

Crown Cork & Seal Co., Baltimore, Md. First nine months, 1954: net profit, $1,271,535, equal to 71¢ a share, compared with $994,584, or 48¢ a share, in the first nine months of 1953.

Dewey & Almy Chemical Co., Cambridge, Mass. First nine months, 1954: net profit, $2,425,721, equal to $2.65 a share, compared with $1,256,116, or $1.37 a share, in the same months of 1953.

Flintkote Co., New York, N. Y., and subsidiaries. Forty weeks ended October 9, 1954: net earnings, $3,822,208, equal to $2.83 each on 1,266,835 common shares, against $3,943,294, or $2.93 each on 1,260,435 shares, a year earlier; net sales, $74,322,939, against $72,274,972.

General Cable Corp., New York, N. Y. First nine months, 1954: net profit, $3,562,925, equal to $1.58 each on 1,936,449 common shares, compared with $3,906,231, or $1.76 each on 1,933,372 shares, in the 1953 months.

General Electric Co., Schenectady, N. Y. January 1-September 30, 1954: consolidated net profit, $140,691,000, equal to $1.62 a common share, against $116,386,000, or $1.34 a share, a year earlier; sales, $2,167,397,000, against $2,341,048,000.

General Motors Corp., Detroit, Mich. Nine months to September 30, 1954: net profit, $584,915,125, equal to $6.58 a share, against $443,101,962, or $5.08 a share, in the 1953 months; sales, $7,219,169,633, against $7,931,026,579.

General Tire & Rubber Co., Akron, O., and subsidiaries. Nine months ended August 31, 1954: net profit, $4,427,452, against $5,505,856 a year earlier; net sales, $154,962,719, against $150,851,345.

The B. F. Goodrich Co., Akron, O. Nine months ended September 30, 1954: net earnings, $27,371,729, equal to $6.22 each on 4,400,657 common shares, against $25,201,898, or $6.01 each on 4,191,979 shares, in the same months of 1953; net sales, $466,499,115, against $520,654,622.

The Goodyear Tire & Rubber Co., Akron, O. First nine months, 1954: net profit, $31,798,688, equal to $6.53 a common share, compared with $7.30 a share in the '53 period; consolidated net sales, $789,177,842, against $920,310,190.

Johnson & Johnson, New Brunswick, N. J., and domestic subsidiaries. First nine months, 1954: net income, $7,701,000, equal to $3.63 a common share, compared with $7,387,000, or $3.49 a share, in the same period the year before; sales, $153,632,000, against $153,730,000.

CALENDAR

Dec. 17. Chicago Rubber Group, Inc. Christmas Party. Morrison Hotel, Chicago, Ill.
Dec. 18. Southern Ohio Rubber Group. Christmas Party.
Dec. 22. Reinforced Plastics Group. New York Section, SPE.
Jan. 18. Elastomer & Plastics Group, Northeastern Section. A. C. S.
Jan. 19. Washington Rubber Group. Potomac Electric Power Co. Bldg., Washington, D. C.
Jan. 19-21. Society of Plastics Engineers. National Conference. Chalfonte-Haddon Hall, Atlantic City, N. J.
Jan. 24-27. Sixth Plant Maintenance & Engineering Show. International Amphitheatre, Chicago, Ill.
Jan. 26. Reinforced Plastics Group. New York Section, SPE.
Jan. 28. Akron Rubber Group. Winter Meeting. Mayflower Hotel, Akron, O.
Jan. 31-Feb. 4. ASTM Committees D-11 and D-20. Netherlands Plaza Hotel, Cincinnati, O.
Feb. 4. Detroit Rubber & Plastics Group, Inc.
Feb. 6-10. National Sporting Goods Assn. Convention & Show. Hotel Morrison, Chicago, Ill.
Feb. 8-10. Tenth Annual Reinforced Plastics Division Conference. Society of Plastics Industry, Inc. Hotel Statler, Los Angeles, Calif.
Feb. 10. Northern California Rubber Group. Fort Wayne Rubber & Plastics Group.
Feb. 15. Elastomer & Plastics Group, Northeastern Section, A. C. S.
Feb. 16. Washington Rubber Group, Potomac Electric Power Co. Bldg., Washington, D. C.
Feb. 18. Chicago Rubber Group, Inc. Furniture Club, Chicago, Ill.
Mar. 10. Northern California Rubber Group. Elastomer & Plastics Group, Northeastern Section, A. C. S.
Mar. 16. Washington Rubber Group. Potomac Electric Power Co. Bldg., Washington, D. C.
Mar. 17-19. Division of High-Polymer Physics. American Physical Society. Baltimore, Md.
Mar. 18. Chicago Rubber Group, Inc. Furniture Club, Chicago, Ill.
Mar. 25. Boston Rubber Group. Somerset Hotel, Boston, Mass.

Hewitt-Robins, Inc., Stamford, Conn. First nine months, 1954: net income, $603,548, equal to $2.10 each on 287,051 shares, constrasted with $865,354, or $3.01 a share, in the 1953 period; net sales, $26,410,944, against $28,629,816.

Byron Jackson Co., Los Angeles, Calif. Nine months ended September 30, 1954: net income, $1,295,864, equal to $2.44 a share, compared with $1,020,007, or $1.92 a share, in the 1953 period.

McNeil Machine & Engineering Co., Akron, O. Nine months ended September 30, 1954: net profit, $2,209,441, equal to $4.01 a common share, contrasted with $1,275,293, or $2.32 a share, in the 1953 months.

Johns-Manville Corp., New York, N. Y., and subsidiaries. First three quarters, 1954: net earnings, $12,711,589, equal to $4 each on 3,178,913 common shares, contrasted with $15,850,435, or $5 each on 3,170,472 shares, in the like period last year; sales, $184,612,937, against $188,832,450.

Minnesota Mining & Mfg. Co., St. Paul, Minn. First three quarters, 1954: net earnings, $17,594,981, equal to $2.11 each on 8,218,985 common shares, contrasted with $13,708,826, or $1.63 a share, a year earlier; net sales, $167,767,471, against $162,996,479.

Monroe Auto Equipment Co., Monroe, Mich. Third quarter, 1954: net loss, $20,745, contrasted with net profit of $56,858 in the same period of 1953.

Mt. Vernon-Woodberry Mills, New York, N. Y. First three quarters, 1954: net income, $388,673, equal to 60¢ a share, contrasted with $1,161,896, or $1.80 a share, in the '53 quarters.

National Lead Co., New York, N. Y. Nine months to September 30, 1954: net profit, $25,776,390, equal to $2.14 a share, contrasted with $20,857,869, or $1.74 a share, a year earlier.

National Rubber Machinery Co., Akron, O. Nine months to September 30, 1954: net income, $553,412, equal to $2.83 each on 195,556 capital shares, compared with $819,513, or $4.19 a share, in the 1953 period; net sales, $7,764,851, against $17,536,475.

Okonite Co., Passaic, N. J. Nine months ended September 30, 1954: net earnings, $701,866, equal to $4.11 a share, contrasted with $2,082,373, or $12.95 a share, in the 1953 period.

Olin Mathieson Chemical Corp., Baltimore, Md. Nine months ended September 30, 1954: net earnings, $24,521,554, equal to $2.17 a share, against $24,983,833, or $2.31 a share, in the previous year's months.

Parke, Davis & Co., Detroit, Mich. First nine months, 1954: net income, $7,052,265, equal to $1.44 a share, compared with $6,707,768, or $1.37 a share, a year earlier.

Pennsylvania Salt Mfg. Co., Philadelphia, Pa. Nine months ended September 30, 1954: net income, $885,279, equal to 71¢ a share, compared with $600,321, or 48¢ a share, in the 1953 period.

Phelps Dodge Corp., New York, N. Y. Nine months to September 30, 1954: net profit, $29,517,069, equal to $2.91 a share, against $27,900,835, or $2.75 a share, a year earlier.

Phillips Petroleum Co., Bartlesville, Okla., and subsidiaries. First three quarters, 1954: net earnings, $55,614,539, equal to $3.80 each on 14,646,530 shares, against $55,458,247, or $3.80 each on 14,603,888 shares, in the 1953 period.

Merry Christmas and Happy New Year

Calco®

AMERICAN Cyanamid COMPANY

INTERMEDIATE & RUBBER CHEMICALS DEPARTMENT

BOUND BROOK, NEW JERSEY

Parker Appliance Co., Cleveland, O. Third quarter, 1954: net profit, $268,490, equal to 69¢ a share, against $281,009, or 73¢ a share, in the third quarter of 1953.

Pittsburgh Plate Glass Co., Pittsburgh, Pa. Nine months ended September 30, 1954: net profit, $27,530,052, equal to $2.99 a share, compared with $30,711,825, or $3.39 a share, a year earlier; sales, $309,278,171, against $346,993,772.

Raybestos-Manhattan, Inc., Passaic, N. J., and domestic subsidiaries. Nine months to September 30, 1954: net profit, $1,665,165, equal to $2.65 each on 628,100 capital shares, compared with $2,402,821, or $3.82 a share, in the 1953 period.

Rome Cable Corp., Rome, N. Y. Six months to September 30, 1954: net income, $412,000, equal to 82¢ each on 499,425 common shares, contrasted with $933,000, or $1.87 each on 498,429 shares, a year earlier.

St. Joseph Lead Co., New York, N. Y., and subsidiaries. Nine months ended September 30, 1954: net income, $4,967,003, equal to $1.83 each on 2,716,222 capital shares, contrasted with $5,965,911, or $2.19 a share, in the corresponding period the year before; net sales, $65,019,154, against $69,269,310.

Seiberling Rubber Co., Akron, O. Nine months ended September 30, 1954: net income, $231,253, equal to 19¢ a common share, contrasted with $762,063, or $1.54 a share, in the 1953 months; consolidated net sales, $27,180,252, against $30,998,937.

Sheller Mfg. Corp., Portland, Ind. January 1-September 30, 1954: net profit, $2,058,630, equal to $2.16 a share, against $2,702,810, or $2.83 a share, in the 1953 period.

Skelly Oil Co., Kansas City, Mo. Nine months to September 30, 1954: net income, $20,933,101, equal to $3.64 a share, compared with $22,600,100, or $3.93 a share, in the 1953 months.

Stauffer Chemical Co., New York, N. Y. First nine months, 1954: net earnings, $4,508,000, equal to $1.92 a common share, against $4,225,000, or $1.80 a share, in the same months of 1953; net sales, $64,174,000, against $59,712,000.

Thermoid Co., Trenton, N. J., and subsidiaries. Nine months to September 30, 1954: net earnings, $614,983, equal to 66¢ each on 800,000 common shares, compared with $886,558, or $1.00 a share, in the corresponding months last year; gross sales, $24,286,172, against $30,316,121.

Timken Roller Bearing Co., Canton, O. Nine months to September 30, 1954: net income, $7,410,388, equal to $3.05 a share, against $8,486,129, or $3.50 a share, in the 1953 period.

Union Asbestos & Rubber Co., Chicago, Ill. First three quarters, 1954: net earnings, $228,015, equal to 48¢ each on 475,176 capital shares, compared with $148,415, or 31¢ a share, a year earlier; net sales, $10,897,670, against $8,490,422.

U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y. Nine months ended September 30, 1954: net loss, $161,052, contrasted with net profit of $135,550 for the 36 weeks ended September 13, 1953.

Union Carbide & Carbon Corp., New York, N. Y. Nine months to September 30, 1954: net profit, $63,145,879, equal to $2.18 each on 28,952,794 capital shares, compared with $78,897,595, or $2.72 a share, a year earlier; sales, $667,143,639, against $782,865,344.

United States Rubber Co., New York, N. Y. Nine months to September 30, 1954: net earnings, $20,084,571, equal to $3.05 a common share, compared with $21,488,326, or $3.32 a share, in the like period of 1953; net sales, $587,269,614, against $657,393,028.

Westinghouse Air Brake Co., Wilmerding, Pa. First nine months, 1954: net earnings, $2,480,253, equal to 60¢ a share, contrasted with $7,112,725, or $1.72 a share, in the 1953 months.

S. S. White Dental Mfg. Co., Philadelphia, Pa. Nine months ended September 30, 1954: net profit, $458,650, equal to $1.25 a share, against $636,259, or $1.75 a share, in the corresponding period of 1954.

Dividends Declared

Company	Stock	Rate	Payable	Stock of Record
Belden Mfg. Co.	Com.	$0.40 q.	Dec. 1	Nov. 17
Borg-Warner Corp.	Com.	1.00 q.	Dec. 1	Nov. 17
		1.00 extra	Dec. 20	Dec. 1
	Pfd.	0.87½ q.	Jan. 3	Dec. 15
Brown Rubber Co., Inc.	Com.	0.25	Dec. 1	Nov. 17
Brunswick-Balke-Collender Co.	Com.	5%	Dec. 21	Dec. 1
	Pfd.	1.25 q.	Jan. 3	Dec. 20
Canada Wire & Cable Co., Ltd.	"A"	1.00 q.	Dec. 15	Nov. 30
	"B"	0.75 int.	Dec. 15	Nov. 30
Crown Cork & Seal Co.	Com.	0.15 q.	Nov. 30	Nov. 9
	$2.00 Pfd.	0.50 q.	Dec. 15	Nov. 16
E. I. du Pont de Nemours & Co., Inc.	Com.	2.50 yr.-end	Dec. 14	Nov. 22
	$4.50 Pfd.	1.12½ q.	Jan. 25	Jan. 10
	$3.50 Pfd.	0.87½ q.	Jan. 25	Jan. 10
Firestone Tire & Rubber Co.	Com.	0.75 extra	Dec. 1	Nov. 15
	4½% Pfd.	1.12½ q.	Dec. 1	Nov. 15
Flintkote Co.	Com.	0.50 yr.-end	Dec. 10	Nov. 26
		0.50 q.	Dec. 10	Nov. 26
	Pfd.	1.00 q.	Dec. 15	Dec. 1
General Electric Co.	Com.	0.40	Jan. 25	Dec. 17
General Motors Corp.	Com.	2.00 yr.-end	Dec. 10	Nov. 10
	$5.00 Pfd.	1.25 q.	Feb. 1	Jan. 10
	$3.75 Pfd.	0.93¾ q.	Feb. 1	Jan. 10
General Tire & Rubber Co.	Com.	0.50 q.	Nov. 30	Nov. 19
Goodyear Tire & Rubber Co.	Com.	1.00 q.	Dec. 10	Nov. 15
Hewitt-Robins, Inc.	Com.	0.50 q.	Dec. 15	Dec. 3
Byron Jackson Co.	Com.	0.40 q.	Nov. 15	Oct. 29
Johns-Manville Corp.	Com.	0.75	Dec. 9	Nov. 29
		1.25 yr-end	Dec. 9	Nov. 29
Johnson & Johnson	Com.	0.35 q.	Dec. 11	Nov. 23
		0.25 extra	Jan. 11	Dec. 23
J. B. Kleinert Rubber Co.	Com.	0.30	Dec. 15	Dec. 1
		0.15 extra	Dec. 15	Dec. 1
Lea Fabrics, Inc.	Com.	0.37½ q.	Nov. 30	Nov. 10
Minnesota Mining & Mfg. Co.	Com.	0.35 q.	Dec. 12	Nov. 20
	Pfd.	1.00 q.	Dec. 12	Nov. 20
National Automotive Fibres, Inc.	Com.	0.25 q.	Dec. 1	Nov. 10
Phelps Dodge Corp.	Com.	0.40 yr.-end	Jan. 1	Dec. 17
		0.65 q.	Dec. 10	Nov. 19
Raybestos-Manhattan, Inc.	Com.	1.50	Jan. 3	Dec. 10
Seiberling Rubber Co.	4½% Pr. Pfd.	1.12 q.	Jan. 1	Dec. 15
A. G. Spalding & Bros., Inc.	Com.	0.25 q.	Dec. 15	Dec. 8
Thermoid Co.	$2.50 Conv. Pfd.	0.62½ q.	Nov. 1	Oct. 11
Thiokol Chemical Corp.	Com.	5%	Dec. 10	Nov. 5
United States Rubber Co.	Com.	0.50 q.	Dec. 11	Nov. 22
	Pfd.	2.00 q.	Dec. 11	Nov. 22
Westinghouse Air Brake Co.	Com.	0.40 q.	Dec. 15	Nov. 26

Foreign Trade Opportunities

The firms and industries listed below recently expressed their interest in buying in the United States or in United States representations. Additional information concerning each import or export opportunity is available to qualified United States firms and may be obtained upon inquiry from the Commercial Intelligence Unit of the United States Department of Commerce, Washington, D. C., or through its field offices, for $1 each. Interested United States companies should correspond directly with the concerns listed concerning any projected business arrangement.

Import Opportunities

Petalon, Ltd., 65 Maygrove Rd., London, NW. 6, England: "Centiduct" and "Ductube" pneumatic tubing (flexible rubber tubing and inflatable rubber tubing) for use in forming concrete pipes, culverts, etc.

A. & L. Perrier & Dardanne, 6 Rue Chinchauvaud, Limoges, Haute-Vienne, France: hand tire pumps.

Sri Krishna Copra & Rubber Mills, Ltd., 228 Grandpass Rd., Colombo 14, India: rubber, sole crepe, and scrap crepe.

Ib Obel Pedersen, 17 Hjemmevej, Copenhagen, Soborg, Denmark: "Thermo Tight" adjustable bottle stoppers made of rubber and aluminum.

Mitsubishi Shoji K. K. (Mitsubishi Shoji Kaisha, Ltd.), No. 10, Marunouchi 2-chome, Chiyoda-ku, Tokyo, Japan: rubber sandals for showers, pools, or lounging.

"LOPA" di Luigi Passuello, 90 Corso Principe Oddone, Turin, Italy: shoes of rubber and cork.

Avon Footwear Sales, Ltd., Gate Rd., The Trading Estate, Bridgend, Glamorgan, Wales: rubber soles and heels.

Majestic Gloves/Footwear Co., 1-3 Gallasplein, Hellevoetsluis, Netherlands: rubber and neoprene safety boots; industrial gloves.

Export Opportunities

Embassy Agencies (Pty), Ltd., 190 Crompton St., Pinetown, Natal, Union of South Africa: glycerine and chemicals for the rubber and tire industries, reclaimed tires.

Marsden Campbell, representing Marsden Campbell Pty., Ltd., 186 Willoughby Rd., Crows Nest, N.S.W., Australia: foam rubber.

Leonard Baines & Co., Ltd., Harley Bldgs., 11 Old Hall St., Liverpool 3, England: titanium dioxide and other raw materials for the rubber industry.

George Vamvakopulos, representing Romilos Vamvakopulos & Bro. and General Trade & Agencies Co., Ltd., both at Guzel Han 1 & 3 Floors, Muhzirbasi Sokak, Sirkecy, Istanbul, Turkey: rubber.

WHITE MOLDINGS PROVE DOW CORNING RELEASE AGENTS KEEP MOLDS CLEAN . . . *cut costs 80%*

Inspector Mike used to fill the scrap bins when white or light-colored parts were running. But Moe Muscles has put an end to all that with Dow Corning silicone release agents. Brilliantly clean and free from surface blemishes, even white parts leave the mold unstained by carbonized lubricants or mold dirt.

That's because Dow Corning silicone mold lubricants can't break down to form a carbonaceous deposit on mold surfaces. Molds stay clean 5 to 20 times longer than they do with ordinary release agents. Sharp detail, closer tolerances and high surface finish are assured — even on heavily loaded stocks. And mold maintenance costs are reduced by as much as 80%.

For easier release, lower production costs, improved quality and better appearance, specify Dow Corning silicone release agents: fluid for green carcass, bead and parting line release; emulsions for molds, mandrels and curing bags.

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DOW CORNING CORPORATION
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ATLANTA CHICAGO CLEVELAND DALLAS DETROIT LOS ANGELES NEW YORK WASHINGTON, D.C. (SILVER SPRING, MD.)

CANADA: DOW CORNING SILICONES LTD., TORONTO ENGLAND: MIDLAND SILICONES LTD., LONDON FRANCE: ST. GOBAIN, PARIS

New Silicone Rubber Gum Can Be Sulfur Vulcanized; Blends Give Organic Rubber More Stability

Rubbery parts with properties intermediate between those of silicone rubber and organic rubbers can now be produced by compounding with a new silicone polymer that can be vulcanized with sulfur and blended in any proportion with organic rubbers.

Identified as Dow Corning 410 Gum and available now in commercial quantities, this new polymer can be blended with or applied as a protective coating to extend the serviceable temperature limits and the weather resistance of organic rubbers. Brittle point in the range of —70°F and usefulness at temperatures up to 400°F can be realized by proper blending. The physical properties of the blend will fall between those of high strength silicone rubber and the organic rubber constituent.

Dow Corning 410 Gum can also be blended with oil resistant rubbers to increase their stability in contact with hot oil. Such blending also markedly improves the ozone and weather resistance of organic rubber.

Tested in an atmosphere created by an ozone generator, for example, a Buna N type rubber, compounded for test purposes, showed failure cracks in less than 30 minutes. Under the same conditions, a fifty-fifty blend of the same organic elastomer and Dow Corning 410 Gum, compounded with the same fillers and vulcanizer showed no cracks after more than 8 hours.

Priced in the same range as standard silicone rubber gums, Dow Corning 410 Gum is currently available for immediate shipment in commercial quantities. Experimental samples for testing and evaluation are available on request.

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DOW CORNING SILICONES

Dow Corning Corporation
Midland, Mich., Dept. M-24

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☐ Technical data on Dow Corning Mold Release Agents

☐ Data and sample for Testing and Evaluating Dow Corning 410 Gum

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- Dayton Rubber's I.T.A. plan has been in existence for 20 years. Rubber experts and teachers that give unexcelled technical assistance at a surprisingly nominal cost . . . all backed by 48 years of recognized leadership in the rubber industry . . . with 4 U. S. plants.
- We train your personnel in these modern plants . . . help you establish the latest formulae for processing natural and all new types of synthetic rubbers and textiles . . . latest "Know-How" in Tubeless Tires, Butyl Tubes, Rayon and Nylon Cords, Carbon Blacks. We also design factories and supervise machinery installations if desired.

Write: International Technical Assistance Division

INTERNATIONAL TECHNICAL ASSISTANCE DIVISION I.T.A. THE DAYTON RUBBER CO. DAYTON, OHIO

Dayton Rubber

Dayton 1, Ohio, U. S. A.
Cable Address: Thorobred

SINCE 1905, MANUFACTURERS OF TIRES AND TUBES

NEWS FROM ABROAD

MALAYA

Further Mudie Report Reactions

To what extent the Malayan Government plans to act in accordance with the recommendations of the Mudie Report, it will not be possible to say until discussions in Council, scheduled to begin this month, have taken place. Meanwhile, such statements as have come in recent weeks from heads of departments involved refer to matters chiefly affecting smallholders.

Thus the Department of Agriculture stated that through its rubber nurseries it would be able to meet the increased demand for improved material that would follow if the rate of replanting were increased, as recommended in the Mudie Report. Smallholders, however, would no longer be able to confine their choice of replanting material chiefly to clonal seedlings, as they have been able to do up to now, but would have to take budwood as well. For there are indications of a possible shortage of clonal seedlings; whereas budwood, which the smallholders seem to shun, is in overabundant supply.

Then there was the announcement by the Chief Replanting Officer that a chemical had been found which could destroy old rubber trees with little labor and at a cost probably less than $20 (Straits) per acre. The chemical, it was added, had the further advantage of being non-poisonous to people and animals and was therefore quite safe to use.

As was mentioned last month, even at that time it was clear that at least one of the recommendations would be rejected: namely, that the replanting grants to smallholders should not be increased. Now it is learned that the grant is in fact to be raised from $400 to $500 (Straits) per acre replanted.

Possibly this decision was the wiser one in view of the fact that the higher prices for rubber in recent months were not calculated to encourage smallholders to sacrifice possible added gains in favor of cutting down their old trees unless the compensation was suffciently tempting.

How quickly smallholders react to an increase in the price of rubber after a period of depressed values is seen in the rise in their September output, which was 23,427 tons against 21,627 tons in August. Indeed, it was the increase in their crop that caused Malayan production figures for September (53,494 tons) to top those for August (52,453) tons.

Confidence in Rubber and in Malaya

In a talk over the radio Ivor Salmond, chairman of the Singapore Chamber of Commerce Rubber Association, told his listeners that all those in the know were sure that natural rubber could and would hold its own against all comers. He added details to show how important rubber was for Singapore itself, as well as for Malaya, for although the Colony's own rubber production was only 1,600 tons a year, she handled between 30% and 40% of total Malayan production, as well as some 350,000 tons from Sumatra, Borneo, and other Southeast Asian rubber countries, annually.

In a sense, the decision of Bukit Selangor Rubber Estates, Ltd., to spend some £20,000 for a central factory to produce concentrated latex may also be considered as an expression of confidence. The directors of the concern consider there is unlimited scope for consumption of latex in foam rubber production and expect their new venture to improve profits.

Closer Indonesian and Malayan Rubber Workers Relations

The rubber plantation workers of Malaya are learning through P. P. Narayanan, the general secretary of the Plantation Workers' Rubber Union of Malaya, that they have a very great deal in common with their fellow rubber workers in Indonesia and that closer contact between the two groups cannot but be of mutual benefit.

Mr. Narayanan had made a four-day visit to Indonesia in October, during which he met leaders of Indonesian rubber unions, and he was able to report that two representatives of Indonesian rubber workers would visit Malaya during November to discuss liaison arrangements for the purpose of improving

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bargaining powers. At the same time they would attend the inaugural meeting of the new national union of plantation workers, The Amalgamated Rubber Workers' Union. This is the first attempt Malayan rubber workers have made to enter closer relations with other rubber workers in Southeast Asia.

In view of the chronic labor unrest in Indonesia, the news of this move is calculated to make rubber men in Malaya rather thoughtful.

INDONESIA

Limited Dirt Content Correlation with RMA Grades

The Archives of Rubber Cultivation, No. 2 (July, 1954), contains several articles of interest to rubber manufacturer and producer alike. The investigations discussed by K. F. Heinisch, under "Statistical Distribution of Dirt in Indonesian Rubber," were undertaken as a necessary preliminary to the dirt content classification proposed by the INIRO which would be based on the consideration that "rubber for different purposes may have a different dirt content provided all classified rubber is reasonably clean."

For the numerous tests carried out, samples were taken from inside the bale, that is, the wrappers—regarded as packing material—were not included in the sampling. Analysis of the data obtained revealed the rather surprising fact that there is no correlation between harmful dirt content and the expected amount of dirt in RMA grades of sheet and crepe; the average dirt content of No. 3 and 4 RSS is lower than for No. 1 RSS; there is no difference between No. 1, 2, and 3 crepes. In the case of Compo (Estate Thin Brown Crepe) thin brown crepes and blankets, however, the dirt content rises as the quality decreases. Because of the widely divergent methods of preparation and standards of cleanliness, there is a considerable spread in the dirt content of any particular grade. At the same time histograms indicate that a small proportion of samples with very high dirt content is responsible for the wide spread.

To get an overall picture of the degrees of cleanliness of rubber and to permit assessment of statistical data, a preliminary division into four classes was instituted: Class I, with harmful dirt content below 0.05%; Class II, below 0.15%; Class III, below 0.30%; and Class IV, above 0.30%. So classified, it was found that of the Indonesian rubbers examined, only a small percentage could be considered really clean; the greater part in almost all the commercial grades, except blankets, came under Class II, that is, their dirt content was between 0.05% and 0.15%. Most of the blanket grades fell under Classes III and IV.

Incidentally, Heinisch points out that a considerable saving of time and rubber would result if samples were prepared so that they could be used for both dirt content tests and tests of Technically Classified Rubber. The procedure for the former is mastication for six minutes at 70° C., and for the latter, homogenizing by six passes and subsequently masticating for three minutes at 70° C., and comparative tests showed that there is practically no difference between the two methods.

Controlled Humidity Important for TC Rubber Tests

In this same issue C. Vervloet and D. Doup, of the AVROS Experiment Station, Medan, Sumatra, have two articles relating to testing TC Rubber.

The first article discusses a comparison of strain values at a load of 5 kg/cm. and stress values at 600% elongation (625% for Scott rings).

As earlier findings at Bogor showed that tropical conditions affect strain and modulus measurements, it was decided to condition the compounds and vulcanizates of estate pale crepes, ribbed smoked sheets, and brown crepes, to be tested, and temperature accordingly was fixed at 21-22° C. and relative humidity at 60%. It was then found that a satisfactory correlation could be established between strain values at a constant load of 5 kg/cm^2 measured with the BRPRA strain tester, and stresses at 625% elongation of rings measured with the Scott ORR-L6 modulus tester.

In the course of experimentation, it was observed that relative humidity has a notable effect on vulcanization behavior, particularly in the fast-curing region. The effect of temperature was also apparent. It was found that higher temperatures and

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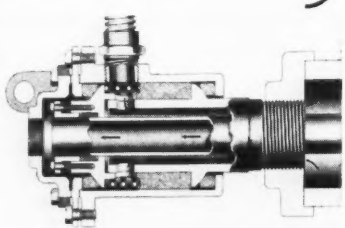

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lower relative humidities both lower stress; for blue rubber, this decrease may amount to more than 10 kg/cm² in the tropics, as compared with the temperate zone; in the rapid test, in which compounds are cured immediately after the mixing cycle on a hot mill, hence with low percentage of humidity, the effect of humidity alone may be of the magnitude of 10 kg/cm² or more. If the effect due to difference in temperature is also included, the total may be as high as 20 kg/cm², depending on atmospheric conditions.

The second article by these two authors is divided into two parts: in the first part the correlation was shown between moduli of rings at 625% elongation, and of dumb-bells at 600% elongation, measured in a conditioned room on the Scott ORR-L6 tester. Part II is a report, illustrated by a number of histograms and tables, of an experiment aimed at tracing the effect of seasonal changes on the intrinsic properties of rubber. For this purpose, the AVROS Testing Station measured the variations in samples of rubber taken once a month for a year, from the bales of sheet rubber produced on one day, by the same East Sumatra estate, and prepared in the same way throughout the testing period.

Report on Mold Growth Progress

The last two articles discuss respectively colorimetric determination of phenol in coal tar, and a method for determining the rate of mold growth in raw rubber.

Coal tar is used in the Far East to prevent diseases of the tapping panel in *Hevea* trees, and for this purpose its phenol content must be low. With the aid of Mellon's reagent a phenol content of even less than 0.1% can be determined so that the method is particularly suitable for use on samples containing less than 10% phenol, P. L. Arens and Thoeng Tek Hoo found.

Susceptibility to mold growth is still a problem in sheet rubber, even an estate product. Th. G. F. Schoon describes a method by which it is possible to obtain reasonably reproducible determinations as a function of time. He was able to express mold resistance of raw rubber as a material constant. Mold resistance of smoked sheet under the atmospheric conditions of a packing shed, of air-dried sheets preserved with chemicals, and of smallholders' smoked sheet was determined in this way.

Rubber Workers Strike at Two Plantations

A wave of strikes on Occidental owned enterprises in the rubber industry took place in the last week of October, in Sumatra.

The first strike to be reported occurred on the Dolok Merangir Rubber Estate, North Sumatra, which belongs to Goodyear (Sumatra) Plantations; about 600 workers—about one-fifth of the total number—struck following a wage dispute. It is understood that the men demanded full wages for a three-week slowdown period last summer during which their output had fallen to one-quarter of normal. The management on its side claimed that the strike was illegal since the government labor arbitration board had not yet ruled on an earlier dispute. At last reports the strike was still continuing a week after it had started.

A few days after the strike at Goodyear's began, 10,000 workers of the Sumatra plantations and offices of the Handels Vereniging Amsterdam went on a one-day strike, for what reason was not stated.

GERMANY

Statistics Show Rubber Industry Gaining

Several records were broken by the West German rubber industry in 1953: rubber consumption, exports, and production of several types of manufactures reached hitherto unknown levels. At the same time factories worked more efficiently; output per worker and per working hour, already above that of 1938 in recent years, showed a further advance in 1953.

As is seen in the table below, in which production of all Germany in 1938 is compared with that for West Germany in 1951, 1952, and 1953, output in the last year, of passenger-car tires, tire repair material, heels and soles, rubber footwear, unspecified soft rubber technical goods, surgical goods and belting, all topped the 1938 figures. To be sure, production of heavy-duty

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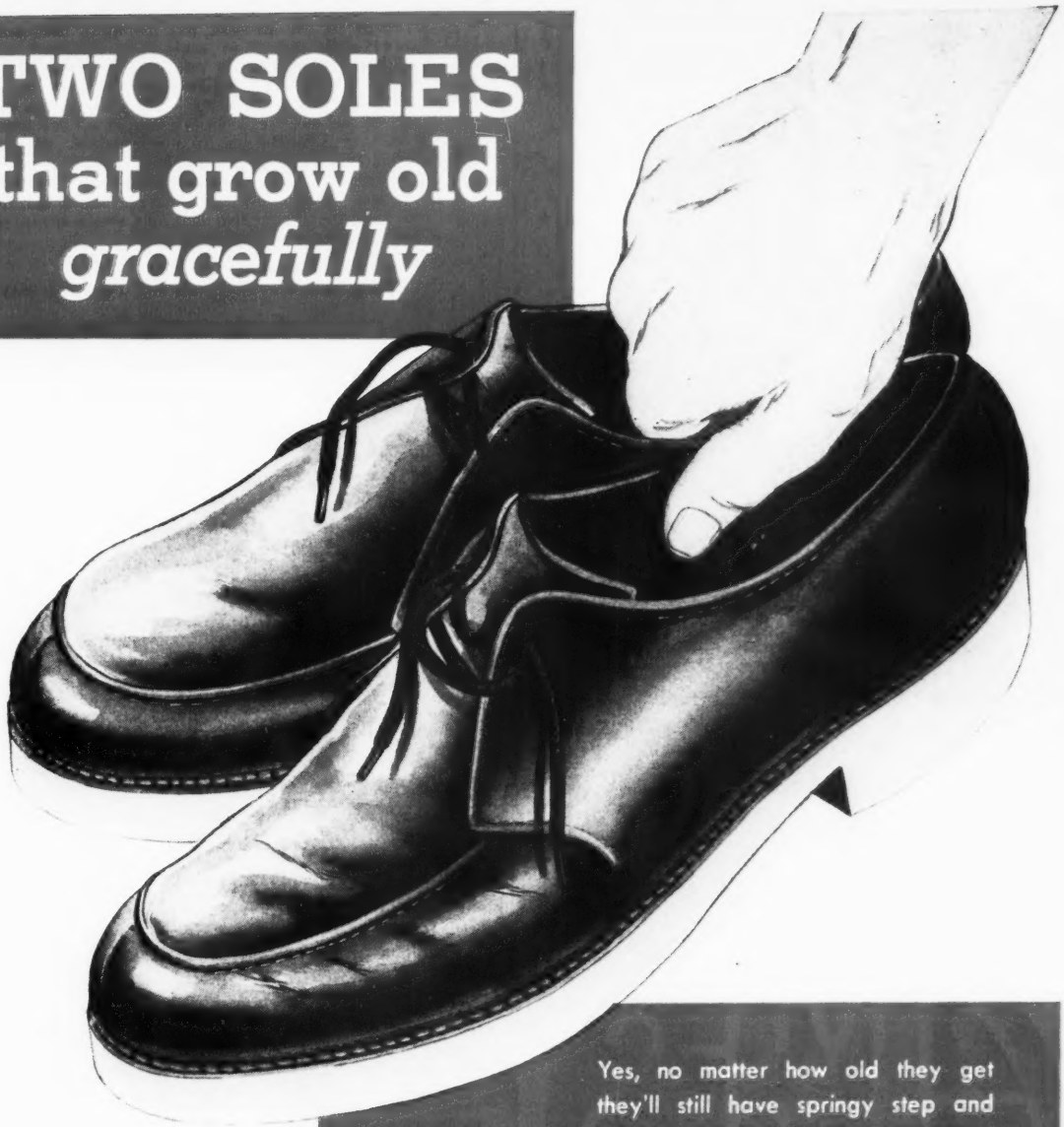

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tires, although on the increase, has not quite caught up to the 1938 figure; while output of cycle tires continues to lag far behind, so that in the end the total for the whole tire industry is still below the prewar level. However the upswing in general rubber goods more than made up for this difference, so that the 1953 total for the entire rubber industry, at 277,885 tons, exceeds that of 1938, at 246,790 tons, by a comfortable margin. It will be remarked that the amounts for hard rubber goods and rubberized fabrics and manufactures thereof have risen but little in the postwar years and are still so far under the 1938 totals as to warrant the assumption that the displacement of rubber by plastics is here in evidence.

PRODUCTION IN 1938 AND 1951, 1952, AND 1953

	All Germany	West Germany Including West Berlin		
	1938	1951	1952	1953
Tires (in tons):				
Cycle	18,804	12,513	10,988	11,992
Motorcycle and passenger car	35,125	32,256	33,915	37,384
Heavy-duty and special	69,195	54,476	60,851	62,645
Tire repair material	5,135	10,010	11,535	12,996
Total	128,259	109,255	117,289	125,017
Other Rubber Manufactures:				
Heels and soles	13,560	24,875	33,335	40,264
Rubber footwear	8,000	11,717	11,943	13,640
Belting	6,470	6,924	7,045	7,493
Lined hose	10,550	7,837	8,026	9,758
Unspecified mechanicals	32,187	35,325	35,287	41,474
Surgical soft rubber, etc.	5,909	4,641	6,126	8,805
Rubberized fabrics and articles thereof	11,116	4,368	4,797	5,902
Other soft rubber goods	20,050	15,230	15,633	19,128
Hard rubber goods	10,689	6,095	6,065	6,404
Total	118,531	117,012	128,257	152,868
Grand Total	246,790	226,267	245,546	277,885

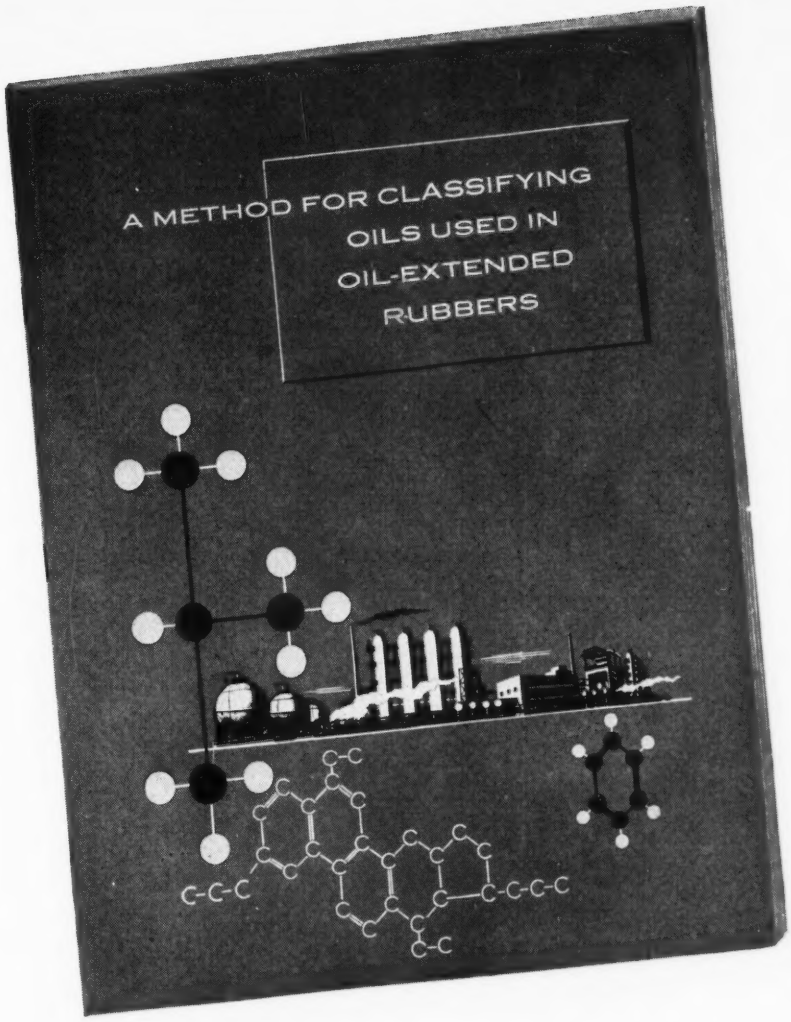
In 1953 the rubber industry employed on an average 64,905 persons, against 67,508 in 1938; rubber consumption included about 120,000 tons of natural and synthetic rubber in 1953 (synthetic rubber accounted for some 12,000 tons), and more than 30,000 tons of reclaim, in all some 150,000 tons. This figure compares with 91,297 tons of natural rubber, 4,677 tons of synthetic rubber, and 36,981 tons of reclaim, used in 1938, in all 132,955 tons.

Details of exports are not yet available, but totals for 1953 were about 25,000 tons, valued at more than 143,000,000 DM., against 17,500 tons, value 108,500,000 DM., in 1952. Both quantity and value for 1953 are said to have been the highest in the history of the German rubber industry; the foreign currency brought into Germany in this way covered 54% of the foreign exchange which was required for the imports of raw and waste rubber.

Unfair Competition and Cartels

The interaction of increased production of automobiles for the home market and more especially for export, greater efficiency permitting lower prices, and interest in new products (foam rubber, for instance) was responsible for the unprecedented activity in the rubber industry. Despite good demand, however, competition was noticeably sharp, which no doubt itself had an effect in further stimulating the market, but the tendency to unfair practices it revealed occasioned much concern in responsible trade and manufacturing circles, and voices in favor of cartels have been raised again.

At a recent meeting of the German Rubber Manufacturers' Association, the chairman explained his stand; he felt that if government measures are unable to control unfair practices, industry must take the matter into its own hands. By way of reply to the usual charges that cartels tend to encourage inefficiency, push up prices, and discourage new directions, he proposed what he called "Rationalization Cartels," which would be obliged to undertake systematic and detailed comparisons of methods and costs of manufacturers and to disseminate the information to increase efficiency, thereby reducing costs in the industry. But the cartels must at the same time be empowered to fix prices so that competing firms may have the assurance that data made public in this way will not in a short time be used to their own hurt or even ruin.



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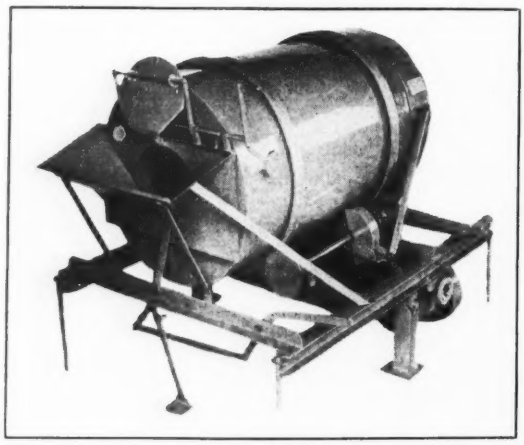

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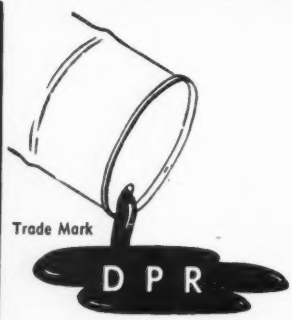

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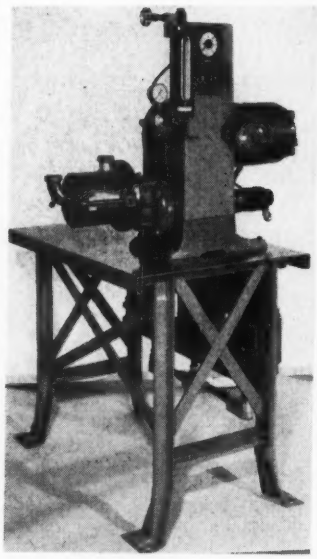


Oakes 5M Blender

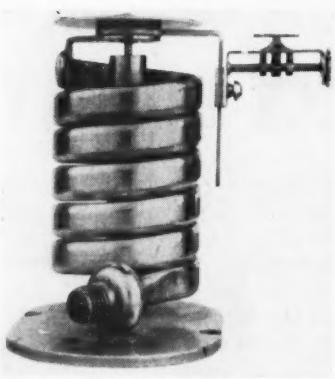
A FOAM latex blender said to help eliminate costly shutdowns caused by the normal tendency of latex to coagulate and clog the foaming heads during the mixing process has been introduced by E. T. Oakes Corp., Islip, N. Y. Called 5M Blender, the machine was designed especially to work in conjunction with the company's continuous automatic mixer.

According to Oakes, the 5M Blender blends the gel and zinc thoroughly into the partially foamed latex coming from the large mixer, without the possibility of clots of coagulated latex forming. Said to be a space saver, the Blender weighs 155 pounds, including a 15-pound mixing head and a 140-pound motor, and stands 24 by 36 inches.

The machine is made throughout of stainless steel; its interior is electropolished to produce a smooth finish that resists latex adhesion, Oakes reports, and all inside pockets and dead ends have been eliminated from previous designs. Capacity of the machine is said to be about 2,000 pounds of foam an hour.

The mechanics of the Blender is said to be as follows: as the partially finished foam passes through it, the zinc oxide slurry is introduced into the stream in the blending head directly through a needle; the gel is atomized into the foam with a jet of air which not only distributes the gel more quickly throughout the mass, but also finishes off the foam structure; the air system is included in the design of the Blender.

Series 200 Pressure Recorders



Foxboro Type 240 Helical Element

A NEW line of pressure measuring elements, said to have greater operating power and improved accuracy, has been announced by The Foxboro Co., Foxboro, Mass. Designated the Series 200, the instruments are intended for direct measurement, remote transmission, and automatic control.

Elements for the low-pressure ranges (10 inches water to 10 psi.) are constructed with a free floating design to provide straight line travel. The higher-pressure range units (10 psi. and above) employ a new pivotless and arborless construction.

The diaphragm Type 200 elements, utilizing a newly developed non-ferrous alloy, are recommended for low-pressure applications between 10-280 inches of water and the equivalent in vacuum. Bellows Type 210, an enclosed unit formed of homogeneous bronze seamless tubing with absolutely uniform wall thicknesses, features a minimum of hysteresis over the pressure ranges from 0-5 to 0-25 psi. and over equivalent vacuum ranges. Spiral Type 230 units, available in four types of metal, feature practically zero friction loss between spring and pen over the ranges from 0-10 to 0-200 psi. and equivalent vacuum ranges to 15 psi.

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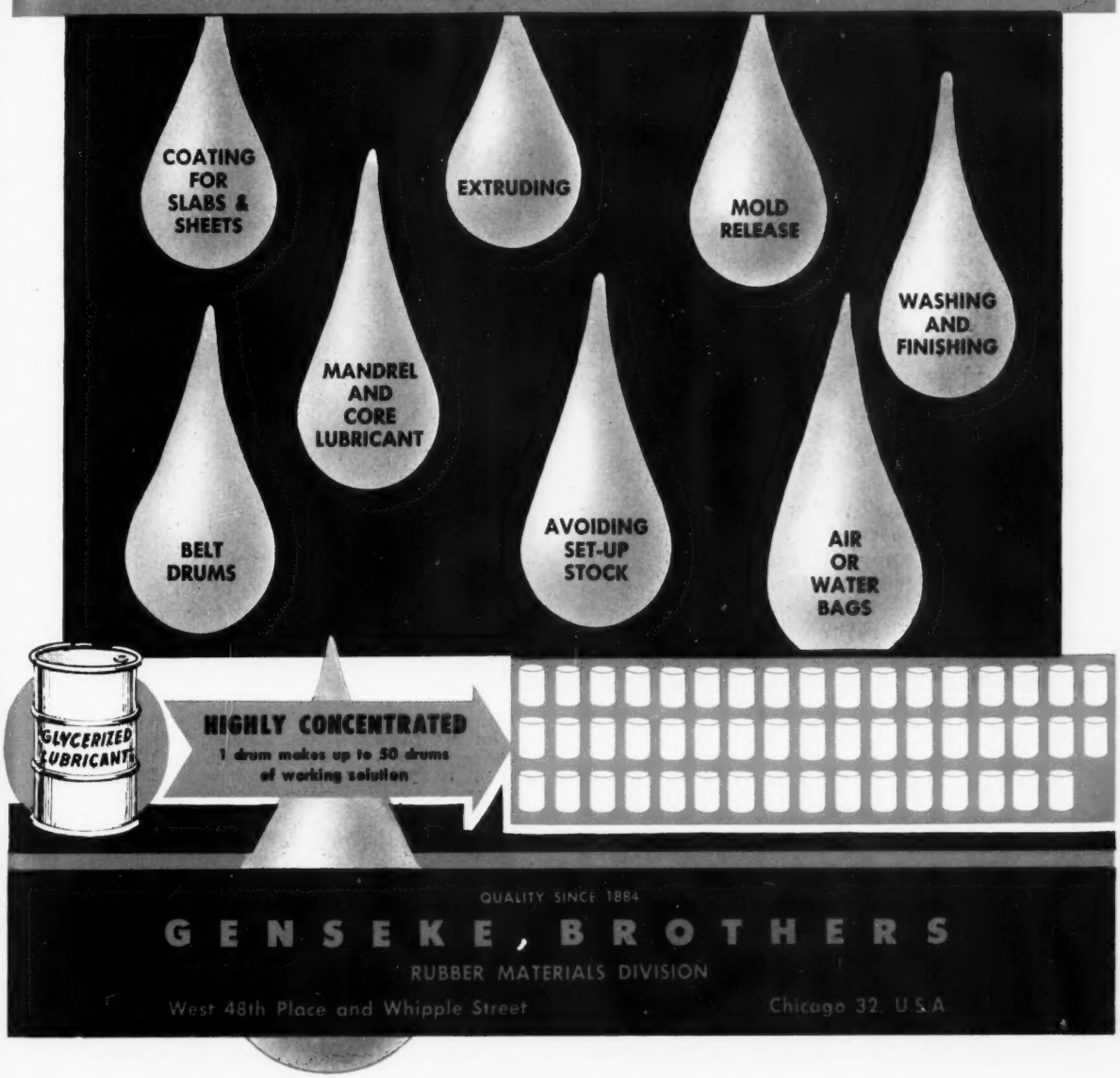

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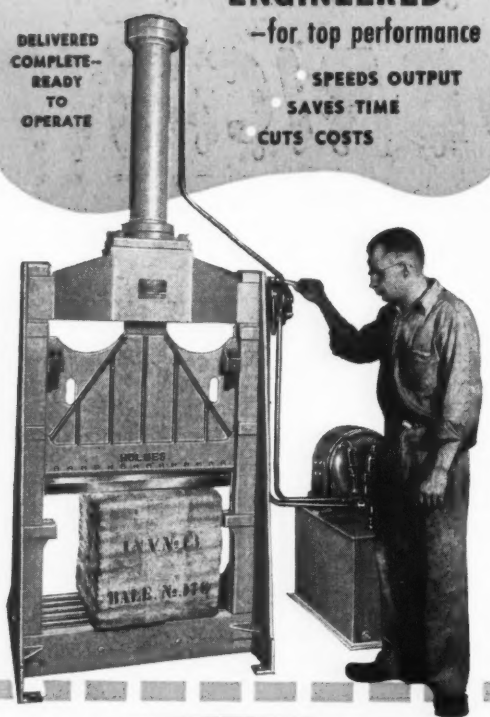

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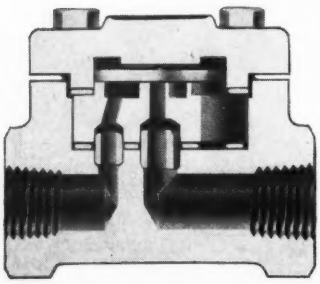
Foxboro has published a bulletin on these "Pressure Recorders," No. 6-10, in which further information on these elements can be found.

Thermodynamic Steam Trap



Sarco Thermodynamic Steam Trap

A NEW steam trap said to have eliminated the use of valve mechanisms, fragile parts, and narrow channels by utilizing the kinetic energy of steam to close the valve has been introduced by Sarco Co., Inc., New York, N. Y. Called Thermodyanic Steam Trap, it has only one moving part, a solid stainless steel valve head that operates effectively under pressures up to 600 psi. and temperatures to 950° F., according to the company.

Manufactured in ½-, ¾-, and one-inch sizes, the body of the trap is of cast semi-steel, carbon, or moly steel with screwed, socket weld, or flanged connections. Field installations have ranged from high-pressure superheated steam mains to unit heaters, tracer lines, and low-pressure radiators, the company reports.

Pressure-Sensitive Tape Maker

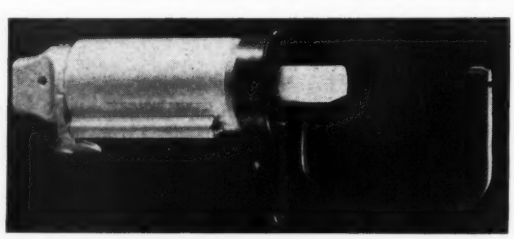
A MACHINE for producing a continuous supply of pressure-sensitive tape, ready for use at the site required, has been introduced by Williamson Adhesives, Inc., Skokie, Ill. Called Williamson Tapemaker, the unit can be installed on production lines to handle standard taping operations such as sealing, labeling, packaging, binding, strapping, and wrapping.

The machine is said to be capable of applying an adhesive film coat to a variety of materials, including cloth, paper, impregnated stock, films, foil, cellophane, and printed surfaces. Enclosed in a finished metal cabinet 16- by 20- by 60-inches, this machine can operate on tape ¼-3 inches wide. The company supplies both materials and adhesive.

Valve Inserting Tool for Tubeless Rims

A TOOL for inserting valves into tubeless tire rims has been introduced by Rotor Tool Co., Cleveland, O. Called Rotor M-1161 Valve Inserter, it is reported to operate on 80-90 pounds of air, has a "C" type of yoke that spans all wheels, and is 13½ inches long and weighs 5½ pounds.

The action of inserting the valve is said to come from an air cylinder and return spring, with one stroke of the tool sufficing to force the valve into place. The device is equipped with bail for suspension from balancer, if necessary, and can also be adjusted to remove faulty valves. According to the company, the Inserter operates as much as five times as fast as hand-operated tools and relieves workmen of much labor.



Rotor M-1161 Tubeless Tire Valve Inserting Tool

New Materials

Dow Corning 99% Pure SiO_2—Silica Soot

A 99% pure silicon dioxide with a particle size of only 10-20 millimicrons has been made available for experimental or developmental purposes by Dow Corning Corp., Midland, Mich. Called Silica Soot, the substance is said to be capable of easy dispersion in elastomeric compounds and in solvent, oil, or water-based systems; individual particles are well defined and non-agglomerating, permitting high surface area absorption.

Uses suggested for the material are as a reinforcing filler for synthetic rubbers and plastics, as a flatting agent and extender for protective coatings, a thickener for lubricating greases, and as an additive in textile finishing. Silica Soot is being pelletized for facility of handling and packaged in pound samples.

Typical properties are as follows:

SiO_2 content, %	99 p'u
Ignition loss, %	
After one hour at 300° C.	0.16
Additional hour at 1000° C.	0.64
Total loss	0.80
Particle size, millimicrons	10-20
Specific gravity	2.2-2.3
Refractive index at 25° C.	1.475
pH	5.3
Bulk density, pounds/cubic foot	5.3
Surface area, sq. meters/gm. (air permeability method)	150-200
Oil absorption, gm. per gm. silica ASTM Method (linseed oil)	4.38

Anti-Cracking Wax for Rubbers

A HIGHLY refined petroleum wax to prevent surface checking and cracking of rubber products comes from Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa. Called Sunoco Anti-Chek, the wax is said to be a primary product, not an uncontrolled blend of lubricating oil by-products, and consequently will not vary in composition from year to year.

Said to be especially valuable for protecting synthetic rubber products which have a greater tendency to crack than have natural rubber goods, typical uses for the wax include application to black tire stock, white sidewall stock, automotive weather stripping, mechanical goods, and wire insulation.

A company bulletin describing Sunoco Anti-Chek, No. 30, is available on request.

Polyester Resin—Marco MR-28RC

A COLOR-FREE polyester resin designed for the manufacture of corrugated and other architectural panels has been developed by the plastics division of Celanese Corp. of America, Newark, N. J. Called Marco MR-28RC, the new resin is said to have a color index lower than A.P.H.A. industry standards, can be light stabilized with an additive, or can be supplied with the light stabilizer included. Celanese is instituting a technical assistance program for fabricators using such resins.

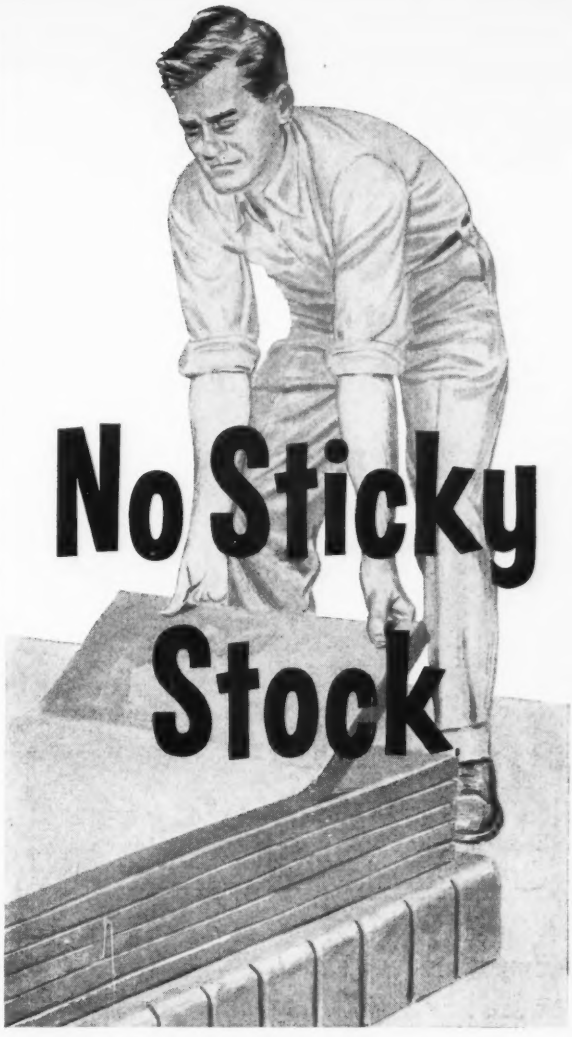
As with the other MR series resins, impregnation with MR-28RC will, according to the company, provide an economical and efficient means for sealing, protecting, and strengthening such products as wood, plaster, metals, concrete, and cinder blocks.

Silicone Gum—SE-30

A LOW-SHRINKAGE, general-purpose silicone rubber gum has been announced as commercially available by the silicone products division of General Electric Co., Waterford, N. Y. Designated SE-30, the gum is said to have good electrical properties, flexibility down to —65° F., and excellent hot tear strength from the mold.

Since there is very little shrinkage, molds and dies designed for organic rubber may be used with compounds made from SE-30, G-E reports. Compounds offering high tensile strength, low compression set, and resistance to temperature elevations may be molded conventionally, extruded, calendered, or knife/dip coated with the new gum formulations.[1]

[1] India Rubber World, Jan., 1954, p. 481.



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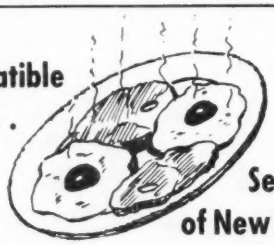

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Thermoplastic Chlorotrifluoroethylene

AN IMPROVED high molecular weight thermoplastic polymer of chlorotrifluoroethylene said to be valuable in applications calling for high-temperature and chemical-resistant properties has been made available by Acme Resin Corp., Forest Park, Ill. Called Polyfluoron, the material can be used as a coating for high-temperature electronic wire insulation, radio tube sockets, printed circuits, valve seats, diaphragms, and gaskets.

Polyfluoron is said to extrude easier and faster and at lower temperatures than similar materials in the same molecular weight range, using conventional thermoplastic molding and extruding processes. Also claimed for it are resistance to heat up to 400° F., resistance to strong alkalies and acids, good resistivity and power factor values at high temperatures, zero water absorption, and a maintenance of dimensional stability from —330 to +374° F.

Films of up to 20 mils have been cast from Polyfluoron dispersion, it is said. Sold and serviced in the East by D & R Pilot Plants, Inc., Hazardville, Conn., the resins are available in grades designated HT, MT, and LT, according to molecular weight, and as crystal granules, powder, or 40%-solids dispersion.

Color Pastes—"4000" Series

COLOR paste concentrates, designed specifically for coloring epoxy, Thiokol, and polyurethane resin systems, have been made available by Claremont Pigment Dispersion Corp., Brooklyn, N. Y. Known as the "4000" series, the pastes are smooth and free-flowing and permit rapid and uniform incorporation of color into liquid resins by simple stirring.

The colors are said to be resistant to light and heat and to various catalysts, as well as to the resins themselves. Colors are widely ranged and include black and metallic silver.

Graft Polymers

(*Continued from page 360*)

thermal instability, which was greater than that of the product obtained by simple admixture of rubber latex and polyvinylidene chloride latex. Its total insolubility in a wide range of solvents and solvent pairs effectively prevented the application of separative procedures as used for methyl methacrylate and styrene. Such gross insolubility was indicative of a graft polymer, but did not afford an unequivocal proof of structure owing to the unknown effect of molecular entanglement and the known insolubilizing effect on rubber of the very active initiator used.

The same dihydroxyacetone initiating system has effected high conversions of acrylonitrile in rubber latex without having recourse to the high proportions of peroxidic initiators used by Compagnon and Le Bras.[4] Again the product was too insoluble for structural analysis. Vulcanized acrylonitrile-modified rubber showed the anticipated resistance to solvents, but its elastic properties were very poor at the levels of acrylonitrile necessary to obtain effective resistance to solvents.

Conclusions

The most promising graft polymers based on natural rubber so far obtained are undoubtedly those derived from methyl methacrylate and styrene. The price and availability of these monomers, the ease of polymerization, the clearly defined nature of the products and the valuable technical properties of their vulcanizates are features which have combined to establish these modified rubbers as promising new materials for technical application.

This work forms part of a program of research undertaken by the Board of the British Rubber Producers Research Association.

New Goods

The Silent Storm King, New Tire by Armstrong Rubber Co.

Noiseless Mud and Snow Tire

A MUD and snow tire said to be of a new design which increases traction and performs noiselessly has been introduced by Armstrong Rubber Co., West Haven, Conn. Called The Silent Storm King, the new tire is reported to feature scientifically staggered grooves for improved gripping power and multiple rows of staggered grip-blocks for quiet operation.

Another advantage claimed for the product is minimization of road sway brought about by larger, deeper bumper bars. Armstrong says that the elimination of rumbling and squealing on dry pavement makes the tire eligible for year-round operation.

New "Silent Traction" Winter Tire

Dunlop Winter Tire

A TIRE said to be particularly suited to ice and snow conditions has been introduced by Dunlop Tire & Rubber Corp., Buffalo, N. Y. Designated "Silent Traction," this tire has skid-resistant properties reported to be attributable to a new tread design which has a center section of closely spaced chevron-like patterns.

A lower noise level and improved wearability are also claimed for the tire. Sizes available are 6.70, 7.10, 7.60, and 8.00, all for 15-inch rim.

Seiberling Vinyl Highway Signs

HIGHWAY signs made from the B. F. Goodrich Co.'s Geon rigid vinyl resin are being manufactured by Seiberling Rubber Co., Akron, O. Designed to replace conventional metal signs which have an approximate life span of three years, the resin products are alleged to be stronger and more durable and are currently being tested by municipal authorities at Barberton and Akron, O.

Of interest to game-hunting states, these signs are undergoing shatter tests, Goodrich reports. At a distance of 60 feet, using .22 long rifle ammunition, 10 holes were shot through a "Stop" sign. The holes on the entrance side were the size of bullets, but the vinyl plastic had closed in on the exit side, leaving holes no larger than wooden match sticks. There was no shattering of the sign material, and the holes were difficult to see at a short distance.

The signs are lightweight and are unaffected by sun, rain, snow, and temperature changes, Goodrich states. When bent, the signs will snap back to their original shape. The message and the border are embossed, giving the illusion of third-dimension for easier reading.

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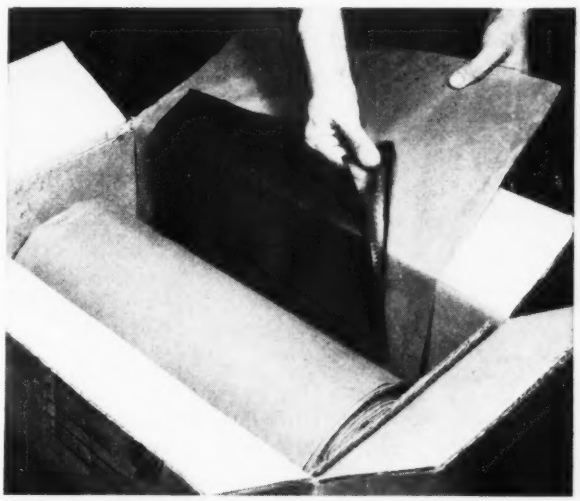

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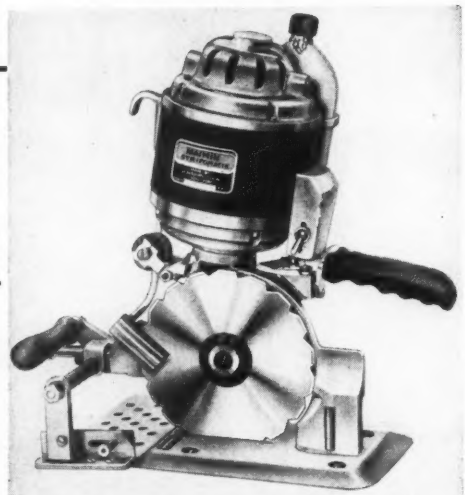

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Hose for Open-Hearth Furnaces

A SUPER-RESISTANT rubber hose for circulating water inside open-hearth steel furnace doors has been announced by the industrial products division of The B. F. Goodrich Co., Akron, O. Reinforced with stainless steel wire and asbestos, the new product is reported capable of passing undamaged through 270 heatings of a furnace, thus outlasting the average life-span of a furnace, which is 150 heats.

In open-hearth steel furnace operations, hose is needed to provide a flexible connection to the water circulation system so that the doors may be opened for recharging. The cooling water prevents the doors from melting in the extreme heat. The hose also draws off the resulting steam. Goodrich reports that the high flexibility of its hose makes shorter connecting links possible, allowing one-man installation and reducing labor costs. The product is being manufactured in one-inch, 1¼-, 1½-, and two-inch sizes.

Dur-Ace Plastic Pipe

CORROSION-RESISTANT rigid polyvinyl chloride pipe said to exhibit exceptional impact strength has been introduced by American Hard Rubber Co., New York, N. Y. Called Dur-Ace, the plastic pipe is reported to be low cost, lightweight, odorless, tasteless, and non-contaminating and resists all inorganic acids and alkalies, but shows limited resistance to strong acids and organic solvents.

According to the company, optimum operating temperatures of the product range from —40 to +170° F.; where physical shock is present outside these temperature limits, the pipe is not recommended. Other characteristics given for the pipe are easy threading and shaping, low moisture absorption, and resistance to electrolytic corrosion, bacteria, fungi, crude oil, gases, and brine solutions.

The pipe is supplied in standard 20-foot lengths in ½-2-inch sizes, with choice of two wall thicknesses, Extra Heavy Duty (IPS Schedule 80) and Standard (IPS Schedule 40). Fittings, flanges, and nipples with standard IPS threads are also available, as well as special custom molded parts and fittings, tubing, extrusions, and fabricated parts.

Working pressures for the Extra Heavy Duty pipe at 70° F. are reported as 300 psi. for ½-inch pipe and 150 psi. for two-inch pipe. Working pressures for Standard pipe are 150 psi. for ½-inch and 75 psi. for two-inch pipe. Maximum working pressures are reduced with temperature rises and are based on a safety factor of 5:1.

U. S. Royal Master Seal

A PUNCTURE-SEALING Butyl rubber tube reported to weigh a third as much as most tubes of its type has been introduced by United States Rubber Co., Rockefeller Center, New York 20, N. Y. Known as U. S. Royal Master Seal, the tube is said to have a non-flowing plastic sealant that permanently repairs it when a puncturing object is removed.

According to the company, the diminished weight reduces running temperature and makes for longer mileage and lower blowout incidence. It adds that a ribbed design channels away any air that might be trapped between the tube and the tire casing.

Air Hose for Use with Pneumatic Tools

FROM Boston Woven Hose & Rubber Co., Cambridge, Mass., comes announcement of a lightweight small-diameter plastic air hose for use with pneumatic tools. Besides the ¼-inch inside-diameter size with ⅛-inch wall, this Bostrene hose is available in ⅜-inch i.d. and 3/16-inch wall thickness at working pressures up to 120 pounds at 75° F. This plastic hose, incidentally, is colored a bright red to permit easy identification of power air lines.

Many advantages are claimed for this new product. It is said to be lighter and more flexible than other air hose and also flame and abrasion resistant as well. Since the ¼-inch size of Bostrene hose weighs only 8.8 pounds per 100 feet, it allows lighter pneumatic tools to be used in place of heavier electric ones.

This hose, moreover, saves cost of manual lubrication of tools by allowing the use of line oilers, the manufacturer further states.

Editor's Book Table

BOOK REVIEWS

"What Every Engineer Should Know about Rubber." W. J. S. Naunton. British Rubber Development Board, Mark Lane, E.C.3, London, England. Cloth, 5½ by 9 inches, 128 pages. Price, 50¢.

The uses of rubber, its sources, properties, manufacture, and testing are included in this book written for the engineer who, the author feels, is not so conversant with rubber as he should be. Illustrations of processing equipment and manufactured items abound.

"Pocket Book of Chemical Technology." V. Stannett and L. Mitlin. Chemical Publishing Co., Inc., 212 Fifth Ave., New York, N. Y. Cloth, 4½ by 7 inches, 290 pages. Price, $4.75.

This volume was designed to provide the most essential chemical and chemical engineering data in handy form to both specialists and plant workers. A glossary of technical terms is included. The authors have compiled a section on radioactive isotopes and labeled compounds, anticipating increased interest in this field.

"100 Stories of Business Success." By the Editors of *Fortune*. Simon & Schuster, Inc., 630 Fifth Ave., New York, N. Y. Cloth, 5½ by 8 inches, 174 pages. Price, $2.95.

These stories tell how 100 American entrepreneurs of our time took their risks, and point out the characteristics and conditions which led to their success, despite taxes, competition, and, usually, very little capital. Typical of these men are Mario Maccaferri, who parlayed a love of music and a fascination for plastics into a gross sales of $3 million a year; William J. Voit, who supplies annually $30 million worth of rubber sports equipment; and Heinz Rollman, who, after losing two fortunes in Europe, is well on his way to a third with his sponge-rubber mid-sole shoe.

NEW PUBLICATIONS

Publications of Argus Chemical Corp., 633 Court St., Brooklyn 31, N. Y.

"Mark Stabilizers." Technical Bulletin #1. 8 pages. Listed in this folder are the physical properties, solubilities, and formulations for seven Mark Stabilizers, and the vinyl resins suggested for use with them.

"Stabilizers Mark M and Mark PL." Technical Bulletin #2. 14 pages. The performance characteristics, physical properties, stability, and resin compatibility of the firm's Mark M and Mark PL stabilizers, as well as specific applications of the resulting resins, are reported in this bulletin.

Publications of Thiokol Chemical Corp., Trenton, N. J.:

"Thiokol Liquid Polymer/Epoxy Resin Casting Compounds." 12 pages. Starting formulations and resulting properties of these casting compounds, curing at room temperature and suitable for electrical potting, plastic tooling, and other applications, are described in this booklet.

"Thiokol Liquid Polymer/Epoxy Resin Laminates." 8 pages. Typical formulations, methods of processing, and properties of these laminates are included in this booklet.

"Thiokol LP-2 Cold Casting Compounds." Technical Service Bulletin No. 115. 4 pages. Trial formulations and properties of cold casting compounds based on Thiokol Liquid Polymer LP-2 are described in this publication. There is negligible shrinkage of the rubbers, according to the company, and they display excellent low-temperature properties and good resistance to aging and weathering.

"Indonex Plasticizers in Industrial Tire Compounds." Circular 13-50. Indoil Chemical Co., 910 S. Michigan Ave., Chicago, Ill. 5 pages. Data and tables giving eight tire compounds using Indonex plasticizers, as well as physical properties, Bashore resilience, compression set, Mooney plasticity, and oil resistance of the finished products, are contained in this folder.

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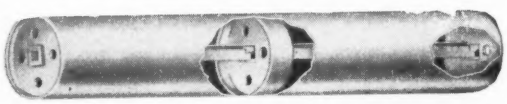

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Publications of E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del.:

"RR-10 Reclaiming Agent and Processing Aid." C. J. Higgins and D. B. Forman. Report No. 54-5, October, 1954. 8 pages. The chemical formula, physical properties, and laboratory findings, as well as tables listing scrap composition and the effect of RR-10 concentration in reclaiming natural and synthetic rubbers, are reported in this bulletin. RR-10 is said to cut down the amount of reclaiming oil used and to aid in the processing of scorched, tough neoprene stocks.

"Neoprene Latex Type 950." J. A. McDonough and J. C. Fitch. Report No. 54-6, October, 1954. *22* pages. Physical and chemical properties of Neoprene Latex Type 950, developed especially for treatment of fibrous materials, and physical properties, tensile and tear strength, and resistance to deterioration of the resulting latex films, are contained in this bulletin. Since the new latex contains a cationic emulsifier, it requires a cationic or non-ionic surfactant and thereby is exhausted efficiently upon anionic fibers. Tables of accelerators, fillers, plasticizers, and thickeners, along with tables showing the water resistance of neoprene films and the applications of its colloidal characteristics to the production of fabrics, are also included.

"Tank Linings of Hypalon." R. B. Shaver. BL-258A, 10-30-54. *2* pages. Low molecular weight polyethylene added to "Hypalon," chlorosulfonated polyethylene, produces a tank lining of high chemical resistance, considerably reduces sticking to the calender rolls during processing at high temperatures, and cuts down shrinkage, according to this bulletin. Latest recommendations for black and non-black chemical resistant tank-lining stocks are also included.

"Copper Inhibitor X-872-L." A. L. Moran. BL-266, 10-30-54. 4 pages. The chemical composition, physical properties, and compounding characteristics of this new inhibitor of the catalytic action of copper on the oxidation of elastomers are given in this bulletin. Tables showing the effect of X-872-L on the oxygen bomb aging of natural rubber and neoprene vulcanizates containing copper stearate are included. X-872-L also deactivates the deleterious effects of other active metals.

"Molded Products of 'Hypalon' for High Temperature Service." B. W. Fuller. BL-267, 10-30-54. 3 pages. This bulletin explains how products for service at temperatures up to 300° F., such as spark plug covers, can be made from "Hypalon," chlorosulfonated polyethylene, by compression, transfer, or injection molding. A suggested formula for spark-plug cover compound, and the properties of ASTM sheets, cured 30 minutes at 307° F., are also given.

"Reduction of Roll Sticking of Neoprene and 'Hypalon' Compounds." M. A. Schoenbeck. BL-268, 10-30-54. *2* pages. Low molecular weight polyethylene, such as A-C Polyethylene No. 6, acts as a release agent for Neoprene Type WHV compounds, Neoprene Type WRT thread compounds, and for calendered "Hypalon" stocks, according to this bulletin.

"The Resistance of 'Hypalon' to Ozone Attack." M. A. Smook. BL-269, 10-30-54. 2 pages. Compounds of "Hypalon," chlorosulfonated polyethylene, appear to be inert to attack by ozone. Gaskets of "Hypalon" can be made for commercial ozone generating equipment, and coatings of "Hypalon" will impart a high degree of ozone resistance to any elastomer, it is said.

Publications of Monsanto Chemical Co., St. Louis 1, Mo.:

"Beta-Chloropropionitrile." October *29*, 1954. *2* pages. The physical and chemical properties of this dinitrile suggested for use as a brightener in nickel plating, are listed in this publication.

"Beta-Chloropropionic Acid." October *29*, 1954. *2* pages. Suggested uses for this aerylonitrile derivative are as an intermediate for resins, surface-active agents, herbicides, and diverse synthetic organic chemicals. The physical and chemical properties of this material also are listed in this bulletin.

"Beta, beta'-Thiodipropionitrile." July 14, 1954. 3 pages. This is another in the company's new dinitrile series. Its physical and chemical properties, uses, toxicity, and safe handling instructions are included in this data sheet.

"Beta, beta'-Oxydipropionitrile." *2* pages. This material is the fourth in the dinitrile series and is suggested for such uses as a selective solvent for countercurrent extraction of aromatics from aliphatic hydrocarbons and as a means of producing plasticizers, polyester copolymers, and polyamides. The material's physical and chemical properties, toxicity, and safe handling instructions are described in this publication.

"1,2-Dichloroethylene." Technical Data Report TX-16. 7 pages. The empirical formula, physical properties, and chemical properties such as isomerization, chlorination, condensation, and polymerization are reported in this bulletin. Toxicity, storage and handling, and potential uses are also discussed. 1,2-Dichloroethylene, a mixture of cis and trans isomers, should not be confused with ethylene dichloride, Monsanto points out, or with 1,1-dichloroethylene, more commonly known as vinylidene chloride.

Publications of Naugatuck Chemical Division of United States Rubber Co., Naugatuck, Conn.:

"Vibrin 114." Bulletin VB-14R. 4 pages. The physical and chemical properties, uses, and accelerated cure characteristics of the company's rigid high exotherm polyester resin are described in this booklet.

"Vibrin 115A." Bulletin VB-7R. 8 pages. Reported here are the physical and chemical properties, glass mat laminate characteristics, and accelerated cure performance of this rigid, heat-resistant polyester resin.

"Vibrin 117." Bulletin VB-3. 6 pages. A general-purpose polyester resin, Vibrin 117 is primarily intended for the manufacture of glass-reinforced products. Its physical and chemical properties, alone and reinforced, are discussed in this publication.

"Silastic Newsletter." Vol. II, No. 4. Dow Corning Corp., Midland, Mich. 5 pages. This edition includes information on sulfur vulcanized silicone rubber gum, tear strength of Silastic stocks, resistance of Silastic to Ucon oils, and dielectric strength of Silastic 132 cloth coating compound.

"Silastic 122." Reference 9-347. 2 pages. This addition to "Silastic Facts" concerns general-purpose silicone rubber paste and supersedes Reference 9-301.

"Silastic 161." Reference 9-345. 2 pages. Superseding Reference 9-307, this addition to "Silastic Facts" concerns the firm's 60-durometer completely compounded silicone rubber.

"Silastic 8-164." Reference 9-348. 2 pages. Another "Silastic Facts" addition, this one discusses Dow Corning's low-compression set silicone rubber stock and replaces Reference 9-329.

Publications of B. F. Goodrich Chemical Co., Rose Bldg., Cleveland 15, O.:

"Hycar Technical Newsletter." Vol. 3, No. 8, August, 1954. 6 pages. This issue contains data on the physical properties and aging characteristics of compounds based on the company's recently introduced cold-polymerized nitrile rubbers, Hycar 1041, 1042, and 1043. Also discussed is the use of Good-rite Vultrol in rubber compounding to prevent scorching, especially during summer months.

"Hycar Technical Newsletter." Volume 3, No. 9. 4 pages. This issue lists two recipes for blending Hycar rubber and Geon vinyl plastics and gives the physical properties and test data of the resulting compounds. Also included is a brief note on the use of Hycar 1001 and 1002 for compounding rubber with both low water swell and high resistance to oils and solvents.

"Hycar Technical Newsletter." Vol. 3, No. 10, October, 1954. 3 pages. The use of calcined magnesium oxides instead of SRF carbon black as a loading pigment in the compounding of Hycar rubber is discussed in this bulletin. The addition of magnesia is said to improve the rubber's resistance to oil at high temperatures, and the company supports its contention by tabulations of test results. Also included in this issue are data concerning Ford Specification M6342A, which covers rubber compounds for automatic transmission seals.

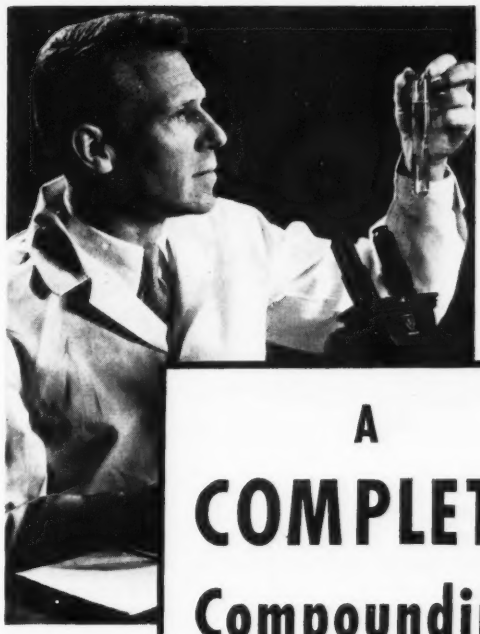
"Bakelite Vinyl Butyral Resins." Technical Release No. 11. Bakelite Co., New York, N. Y. 28 pages. Described in this publication are the properties of vinyl butyral resins and their applications, such as in safety glass, as wash primers or metal conditioners, wood and metal finishes, adhesives, and cloth coatings.

"Bakelite Vinyl Dispersion Resin QYNV." Technical Release No. 14. 36 pages. This booklet contains data on the compounding and application techniques for plastisols and organosols based on the firm's vinyl dispersion resin QYNV. Uses include low-cost coatings on wire goods, paper, fabric, foil, and electrical assemblies.

"1955 Condensed Reference File of Bakelite Plastics and Resins." G-19. 12 pages. Physical properties of more than 50 Bakelite plastics and resins of various types are given in this booklet, classified according to usage. Photographs of applications of the finished products are included.

"1955 Guide to Improved Packaging with Bakelite Plastics and Resins." G-21. 8 pages. This illustrated booklet lists the latest developments by Bakelite in plastic packaging of consumer and industrial products. Properties of molded and blown plastics coatings, adhesives, film, and rigid sheet materials are described.

"Bi-Monthly Supplement to Lists of Accident, Automotive, Burglary Protection, Electrical, Hazardous Location Electrical, Fire Protection, and Gas and Oil Equipment." August, 1954. Underwriters' Laboratories, Inc., Chicago, Ill. 121 pages.



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"The Story of Achievement." Francis Shaw & Co., Ltd, Manchester, England. 22 pages. This illustrated booklet covers the history, organizational setup, and scope of this English manufacturer of machinery and equipment for the rubber and plastics industries.

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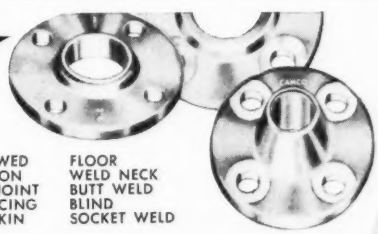

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MARKET REVIEWS

RUBBER

Prices on both the spot and futures markets continued to rise during the period from October 16 to November 15, and trading was moderately active. R.S.S. #1 advanced to 29¢ a pound on November 8, the highest price since January, 1953, and a gain of 2.25¢ over the start of the period. All futures set life-of-contract highs on November 8, registering an average boost of 1.7¢ at the period's end.

Observers say that the present firmness of the market is the result of relative insufficiency of near rubber for the satisfaction of high current demand. Political instability in the Far East is not seen to be a factor. The short supply is mostly attributed to the spiralling production of the tubeless tire and the apparent ability of natural rubber to hold its own against the encroachment of synthetics.

Figures recently released by the United States Department of Commerce reveal that world consumption of natural rubber reached 1,255,000 tons during the first nine months of this year, a 57,500-ton increment over the corresponding 1953 figure.

In futures trading, near December stocks began the period at 26.80¢ and climbed with minor fluctuation to a seasonal high of 28.75¢ on November 8, declining to 28.05¢ by November 15.

Total sales during the second half of October amounted to 8,030 tons, bringing the month's figure to 15,550 tons. During the first half of November, 9,380 tons were traded.

COMMODITY EXCHANGE
WEEK-END CLOSING PRICES

Futures	Aug. 21	Sept. 25	Oct. 23	Oct. 30	Nov. 6	Nov. 13
Dec. 1955	23.70	24.84	27.55	27.15	28.20	28.45
Mar.	23.80	25.00	27.10	26.95	28.00	28.49
May	23.85	25.00	26.87	26.75	27.90	28.40
July	23.90	25.05	26.70	26.60	27.60	28.20
Sept.	23.90	25.05	26.55	26.45	27.50	28.10
Dec.	....	25.05	26.55	26.35	27.45	28.00
Total weekly sales, tons	2,150	2,630	4,390	3,610	3,820	4,350

On the physical market, R.S.S. #1 began the period at 26.75¢ a pound, rose to 27.63¢ on October 25 and 26, lost ground somewhat, then catapulted to 29¢ on November 8, and declined slightly to 28.50¢ by November 15.

October monthly average spot prices for certain grades were as follows: R.S.S. #1, 26.85¢; R.S.S. #3, 26.60¢; #3 Amber Blankets, 26.23¢; and Flat Bark, 22.39¢.

NEW YORK SPOT MARKET
WEEK-END CLOSING PRICES

	Aug. 21	Sept. 25	Oct. 23	Oct. 30	Nov. 6	Nov. 13
R.S.S.: #1	23.50	24.75	27.50	27.25	28.25	28.75
2	23.38	24.63	27.38	27.13	28.13	28.63
3	23.25	24.50	27.25	27.00	28.00	28.50
Latex Crepe						
#1 Thick	32.63	32.13	33.63	33.63	34.13	33.88
Thin	28.13	28.75	31.13	30.88	31.50	31.75
#3 Amber Blankets	23.88	24.50	26.63	26.38	26.88	27.25
Thin Brown Crepe	23.13	23.75	26.00	25.63	26.00	26.25
Flat Bark	19.50	20.63	23.00	22.50	22.88	23.00

Latex

The price for *Hevea* latex rose again during the period from October 16 to November 15 and now hovers around the 35¢-a-pound level. Some observers attribute this boost to the increasing demand for off-grade rubbers, but see no logic in the rise in view of reports of Far Eastern over-production. Accumulation of heavy inventories, normal for this time of year, is not proceeding according to expectation, with many consumers holding their purchases in abeyance in anticipation of a price drop.

Final August and preliminary September domestic statistics for natural and synthetic rubber latices follow:

(All Figures in Long Tons, Dry Weight)

	Production	Imports	Consumption	Month-End Stocks
Natural latices				
August	0	7,571	5,228	12,009
September	0	—	7,224	11,662
GR-S latices				
August	1,850	145	2,834	4,220
September	3,955	235	3,518	4,512
Neoprene latices				
August	756	0	561	1,019
September	676	0	548	978
Nitrile latices				
August	682	0	351	993
September	581	0	355	937

GR-S X-767 Assigned to High Solids Latex

The designation X-767 has been assigned to a high solids X-758 type of latex with approximately 40% bound styrene in the contained polymer, according to S. D. Morgan, sales division chief, Office of Synthetic Rubber, Federal Facilities Corp., Washington 25, D. C.

X-767 is described as a low-temperature polymerized high solids butadiene-styrene copolymer latex 65/35 rosin/fatty acid soap emulsified, sulfoxylate activated, carbamate shortstopped, with potassium oleate as the stabilizer soap. Bound styrene in the contained polymer is approximately 40.0%, and mean Mooney of the contained polymer is 140 ML-4 at 212° F. The latex is heat concentrated to 60.0% minimum.

The purchase price of X-767 in tank-car quantities will be 26.75¢ per pound TDLS plus the applicable uniform freight charge.

Of particular interest as a replacement for X-633 and X-710, and valuable in general-purpose applications, coatings, and backings, X-767 is said to have improved film and color properties. It will be assigned a permanent number at the end of a six-month evaluation period, Mr. Morgan reports, but its production will be continued after that only if the demand is sufficient to warrant economic production runs.

RECLAIMED RUBBER

Activity increased perceptibly on the reclaimed rubber market during the period from October 16 to November 15; observers cited the high price of natural rubber, the introduction of new automotive models, and the apparent acceptance of the tubeless tire for standard equipment as reasons for the sudden acceleration. Reclaimers express optimism over the situation.

Final August and preliminary September statistics on the domestic industry have been released by the United States Department of Commerce. August figures, in long tons, were: production, 15,444; imports, 75; consumption, 17,660; exports, 647; and month-end stocks, 27,692. Preliminary data for September, in long tons, are: production, 22,426; imports, 105; consumption, 19,699; exports, 617; and month-end stocks, 30,153.

Although reclaim prices held steady during the period, some manufacturers were complaining about the tendency on the part of scrap dealers to edge up prices of various scrap rubbers, notably Butyl tubes. Current prices are as follows:

Reclaimed Rubber Prices

	Lb.
Whole tire: first line	$0.10
Fourth line	.0875
Inner tube: black	.15
Red	.21
Butyl	.125
Pure gum, light colored	.23
Mechanical, light colored	.135

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

SCRAP RUBBER

Slow trading conditions prevailed on the scrap rubber market during the first half of the period from October 16 to November 15, but a strong demand for Butyl scrap rubber tubes stimulated the market later on. Mixed auto tires were also being bought in fair lots against November shipment orders for Naugatuck. Observers reported that most of Naugatuck's mixed auto tire order for October had already been shipped.

A striking rise of $2 a ton on mixed auto tires at eastern points occurred during the period.

Current dealers' buying prices for scrap rubber grades, in carload lots delivered to mills at the points indicated, are:

	Eastern Points	Akron, O.
	(Per Net Ton)	
Mixed auto tires	$11.00	$11.50
S. A. G. auto tires	Nom.	13.00
Truck tires	Nom.	14.00
Peelings, No. 1	40.00/41.00	40.00/42.00
2	Nom.	Nom.
3	15.50	Nom.
Tire buffing	18.00/20.00	15.00/16.00
	(¢ per Lb.)	
Auto tubes, mixed	3.00	3.25
Black	5.00	5.00
Red	7.00	7.00
Butyl	2.75	2.75

COTTON FABRICS

Trading on the industrial fabric and cotton duck markets ranged from sluggish to moderate during the period from October 16 to November 15. Enameling ducks sold in fair-sized volume for delivery in December, continuing the trend first noted in early November. The demand for all types of cotton ducks showed a definite upsurge toward the period's end, with a goodly amount of seasonal buying taking place for prompt and forward deliveries.

(*Continued on page 429*)

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Licensed chemical engineer; 14 years' experience in the latex industry in development, design, construction, sales, and management; four years' active duty as a naval officer; desires sales position. Address Box No. 1613, care of RUBBER WORLD.

RUBBER TECHNICIAN, DESIRES TO RELOCATE. OVER 20 years' experience in the wire and cable industry. Experience includes development and compounding, rubber and plastic extruding, laboratory control, factory control. Can handle people, reliable and steady. Address Box No. 1614, care of RUBBER WORLD.

EXECUTIVE—CHEMICAL ENGINEER WITH OVER 25 YEARS' experience in rubber and plastics industries desires position as general manager. Proven works manager with strong background of production, technical development, labor relations, and costing. Address Box No. 1615, care of RUBBER WORLD.

SITUATIONS OPEN

CHIEF DEVELOPMENT CHEMIST

Excellent opportunity for development chemist experienced with solvent-type rubber adhesives. Well-established, growing eastern concern. Address Box No. 1604, care of RUBBER WORLD.

OPPORTUNITY FOR CHIEF ENGINEER WITH MEDIUM-sized Midwest Rubber Company manufacturing molded and extruded mechanical goods. Strong background in rubber tooling and processing essential. Engineering degree preferred, but not essential. Man selected will have the cooperation of present Chief Engineer, who is accepting other duties. Address Box No. 1605, care of RUBBER WORLD.

RUBBER CHEMISTS

A fast-growing concern in the Midwest has opportunities for graduate chemists with two to five years' experience in resin and rubber-type adhesive coatings. Work would include laboratory-scale applied research projects, plus follow-through in pilot plant. Products are pressure-sensitive tape and adhesives for specialized industrial uses. Excellent working conditions. Salary commensurate with experience. Send complete résumé with first letter. Address Box No. 1606, care of RUBBER WORLD.

DEVELOPMENT ENGINEER

A fast-growing concern in the Midwest has opportunities for chemical engineers with a minimum of three years' development experience in resin and rubber-type adhesive coatings or similar field. Position would require following through on research projects completed in pilot-plant phase, and putting them into commercial production. Also consist of developing new processing techniques and equipment modification for operations including knife over roll and reverse roll coating; infra-red and hot air curing; high-speed cutting and slitting of cloth and paper from a continuous roll. Salary commensurate with experience. Please submit complete abstract with first letter. All replies handled in strictest confidence. Our employes know of this ad. Address Box No. 1607, care of RUBBER WORLD.

HELP WANTED—MALE

Rubber chemist experienced in coating of fabrics. Eastern area. Excellent opportunity. Give particulars and salary expected. Address Box No. 1608, care of RUBBER WORLD.

Rubber Compounder and Development Man

Republic Rubber Division, Lee Rubber and Tire Corporation, has an opening for an experienced Rubber Compounder and Development Man. Applications are invited from men with experience in Rubber Compounding and Development work on hose, belting, packing or molded rubber goods. Write, in confidence, to Mr. E. M. Ikirt, General Manager, Republic Rubber Division, Youngstown, Ohio.

SITUATIONS OPEN (Continued)

RUBBER COMPOUNDERS

• Several salaried positions now exist in a new development group for qualified men with a minimum of a B.S. degree in Chemistry, or Chemical Engineering. Applicants should possess experience in one or more of the following fields: Tires, Mechanical Goods, Shoe Products, Flooring or Wiring Insulation. Work will include specification compounding, polymer evaluation, development of sales literature, and technical sales service on synthetic rubber polymers.

• Position also open for qualified technical man having a minimum of 10 years rubber experience to direct activities of the above group.

• Permanent location in Akron, Ohio. Replies should give details of education and experience and should include minimum salary acceptable.

R. N. Whitcomb
Sales & Office Personnel 806-2-J-3
Goodyear Tire & Rubber Co.
1144 East Market Street
Akron 16, Ohio

TECHNICAL SALESMAN, GRADUATE CHEMIST, WITH AT least five years' experience compounding natural rubber latex to sell Revertex in eastern states. Write fully to H. L. BLACHFORD, INC., 24 Commerce Street, Newark 2, N. J.

WIRE AND CABLE: LABORATORY HAS OPENING FOR chemist experienced in wire and cable development work, and for young chemist or engineer looking for an excellent place to gain experience. Address: Chief Chemist, Collyer Insulated Wire Company, Roosevelt Avenue, Pawtucket, R. I.

GENERAL MANAGER FOR AAA RATED WELL-ESTABLISHED firm manufacturing industrial latex adhesives—rug backing, dipped goods, etc. One with chemical background preferred, but not essential. Excellent opportunity to start and advancement. In reply give full details on experience, education, background. Replies strictly confidential. Address Box No. 1609, care of RUBBER WORLD.

RUBBER TECHNOLOGIST

AAA rated manufacturer needs man experienced in compounding rubber and other elastomers for chemical linings. Will work in capacity of project engineer. Must also know bonding to metal and lab. testing techniques. Modern plant and pleasant surroundings. Excellent opportunity with salary commensurate with ability. Write details of education and experience in first communication. DeZurik Shower Co., Sartell, Minnesota.

SALES ENGINEER

Large midwestern industrial goods manufacturer desires sales engineer with background in industrial rubber and plastics. Man to service field personnel and assist in customer contact. 50% traveling to be expected. Position will be closely allied with product and sales development. Excellent opportunity for aggressive sales-type personality with imagination for new products. Address Box No. 1621, care of RUBBER WORLD.

(Classified Advertisements Continued on Page 430)

U. S. Imports, Exports, and Reexports of Crude and Manufactured Rubber

	March		April		May		June		Six-Month Totals	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Exports of Domestic Merchandise										
UNMANUFACTURED, LBS.										
Crude rubber	1,025	$ 624	.....	.....	4,004	$ 2,586	3,995	$ 3,033	9,024	$ 6,243
Chicle and chewing gum bases	287,724	129,272	596,740	$ 226,287	236,247	92,531	381,059	162,974	2,084,281	849,003
Balata, gutta percha, etc.	.....	.....	765	1,884	1,100	2,381	500	1,175	7,719	10,083
Synthetic rubbers										
GR-S types	2,833,904	730,410	1,164,084	371,350	2,497,114	613,643	1,971,324	553,351	10,984,156	2,997,322
Butyl	932,600	207,920	139,000	30,580	836,523	194,851	483,763	110,174	2,396,666	545,856
Neoprene	2,082,610	928,527	2,902,281	1,261,771	1,889,736	792,551	1,553,891	658,120	12,202,818	5,310,964
Nitrile type	644,443	344,910	1,018,545	534,775	884,273	471,650	481,177	243,931	4,332,651	2,287,268
Other	54,329	39,127	57,029	60,172	73,237	51,769	61,696	56,932	485,750	372,145
Reclaimed rubber	1,858,645	159,067	2,352,461	208,532	2,398,831	207,098	2,391,882	211,250	13,153,587	1,149,207
Scrap rubber	2,111,379	60,426	4,290,563	97,430	1,797,580	47,122	2,003,675	59,586	13,713,972	353,891
TOTALS	10,806,659	$ 2,600,283	12,521,468	$ 2,792,781	10,618,645	$ 2,476,182	9,332,962	2,060,526	59,370,623	$13,881,982
MANUFACTURED										
Rubber cement ...gals.	69,523	$ 120,959	80,521	$ 188,319	74,066	$ 147,752	72,502	$ 164,984	448,583	$ 888,549
And rubberized fabric ...sq. yds.	123,270	112,141	196,666	173,596	261,773	189,885	135,351	146,024	1,114,458	971,155
Clothing	.....	162,966	.....	240,618	.....	180,749	.....	139,955	.....	959,514
Footwear										
Boots and shoes ...prs.	17,972	39,957	11,009	47,008	10,112	41,198	8,877	30,447	68,131	224,707
Rubber-soled canvas shoes ...prs.	19,925	23,879	12,048	26,244	10,174	23,121	9,041	20,996	82,201	157,584
Heels ...doz. prs.	68,967	84,506	88,630	102,470	87,717	105,322	41,006	48,720	417,592	488,232
Soles, soling, toplift sheets ...lbs.	733,033	166,508	1,141,777	390,019	826,794	214,487	1,097,268	275,029	5,221,140	1,433,434
Gloves and mittens doz. prs.	15,798	65,559	26,273	107,549	24,887	100,614	21,744	102,806	129,680	543,490
Drug sundries	.....	186,245	.....	267,539	.....	184,321	.....	219,345	.....	1,226,356
Toys, balls, novelties	.....	50,369	.....	66,282	.....	77,260	.....	64,511	.....	345,854
Hard rubber goods										
Battery boxes ...no.	25,743	61,465	19,120	41,311	34,621	59,607	22,274	42,236	165,759	329,699
Other electrical goods ..lbs.	94,532	68,323	300,396	203,063	197,348	112,329	298,676	210,712	1,340,345	894,096
Other	.....	47,758	.....	27,418	.....	14,515	.....	24,870	.....	171,773
Rubber tires and casings										
Truck and bus ...no.	45,928	2,070,789	84,137	3,985,737	84,398	3,846,718	68,122	3,301,066	391,332	17,938,004
Auto and motorcycle .no.	33,680	400,728	93,998	1,277,283	108,165	1,552,558	99,349	1,241,935	451,139	5,932,032
Aircraft ...no.	1,949	124,407	3,349	205,929	6,046	319,227	5,775	219,953	25,408	1,380,325
Off-the-road ...no.	8,356	757,427	18,186	1,677,039	20,865	1,973,980	12,142	1,173,087	81,627	7,591,545
Farm tractor ...no.	4,963	146,188	7,438	309,594	7,327	295,668	6,780	272,302	34,751	1,356,947
Implement ...no.	785	10,455	1,324	19,287	2,699	55,472	2,094	23,482	10,733	183,089
Other ...no.	4,907	38,235	37,590	66,892	9,297	57,565	14,362	52,531	82,639	289,602
Inner tubes										
Auto ...no.	13,916	25,618	37,553	68,435	43,849	113,834	31,412	66,168	166,745	346,567
Truck and bus ...no.	34,788	141,179	51,690	209,475	60,529	246,478	36,800	156,698	254,634	1,021,082
Aircraft ...no.	1,688	14,700	6,228	49,835	764	10,874	2,786	22,028	15,114	126,039
Other ...no.	10,086	19,853	22,324	60,164	18,613	63,558	18,742	42,708	88,685	260,957
Solid tires: truck and commercial ...lbs.	1,579	25,932	1,656	38,683	1,128	21,570	1,480	35,072	8,524	190,566
Tire repair material										
Camelback ...lbs.	948,971	253,106	727,113	206,038	393,188	113,400	489,845	145,951	3,979,213	1,765,357
Other ...lbs.	277,045	208,745	404,319	400,117	347,398	326,507	282,855	279,308	1,824,468	1,619,877
Tape, except medical and friction ...lbs.	26,876	36,929	91,312	94,268	66,384	57,371	51,473	45,525	310,134	300,335
Belting										
V-type, vehicle, fan ..lbs.	54,667	80,786	136,305	183,665	92,490	138,877	86,105	119,534	522,259	747,071
Transmission										
V-type ...lbs.	74,052	141,797	107,313	213,790	83,869	169,759	81,972	164,994	508,835	1,013,619
Flat belts ...lbs.	33,900	50,691	73,713	102,340	36,112	69,039	45,659	73,771	276,646	415,324
Conveyor and elevator ...lbs.	107,052	90,828	131,901	132,068	98,318	102,299	254,515	243,672	724,416	690,737
Other ...lbs.	4,043	2,607	5,875	11,756	2,688	4,166	837	3,358	15,906	27,929
Hose										
Molded and braided. lbs.	221,027	192,580	459,413	382,446	367,173	318,647	341,317	305,059	1,931,262	1,654,272
Wrapped and hand built ...lbs	106,325	107,376	162,946	157,658	123,285	132,072	151,813	154,312	815,940	807,106
Other hose and tubing ...lbs.	71,909	70,080	90,679	102,247	109,196	105,092	113,742	119,870	532,197	567,921
Packing										
Sheet type ...lbs.	40,544	19,408	49,908	26,499	30,085	16,362	64,724	34,308	273,813	152,197
Other ...lbs.	133,239	171,884	153,087	228,224	188,700	235,465	171,576	199,659	993,345	1,385,165
Tiling and flooring ...lbs.	139,517	41,000	171,169	59,053	104,825	29,128	189,561	52,956	945,727	304,174
Mats and matting ...lbs.	413,057	117,375	363,112	114,906	355,572	101,726	296,097	99,257	2,265,637	731,211
Thread										
Bare ...lbs.	19,573	38,122	23,645	37,785	19,568	35,144	28,123	43,259	128,345	212,034
Textile covered ...lbs.	12,677	43,892	24,883	74,039	23,283	71,194	16,753	45,972	109,738	332,605
Compounded rubber for further manufacture ...lbs.	674,149	189,235	623,899	267,686	493,827	205,514	384,740	197,645	3,733,226	1,413,612
Other rubber manufactures	.....	499,381	.....	743,621	.....	630,410	.....	524,525	.....	3,621,201
TOTALS	.....	$ 7,321,968	.....	$13,306,995	.....	$12,870,834	.....	$10,950,600	.....	$62,281,872
GRAND TOTALS, ALL RUBBER EXPORTS	.....	$ 9,922,251	.....	$16,099,776	.....	$15,347,016	.....	$13,011,126	.....	$76,163,854
Reexports of Foreign Merchandise										
UNMANUFACTURED, LBS.										
Crude rubber	1,029,562	$ 273,649	2,055,858	$ 458,728	795,774	$ 221,019	1,173,245	$ 302,644	7,934,891	$ 1,999,635
Balata, gutta percha, etc.	.....	.....	.....	.....	2,498	949	.....	.....	10,011	4,990
Chicle and chewing gum bases	.....	.....	92,340	78,946	32,416	24,500	.....	.....	130,583	107,210
Scrap rubber	44,520	1,336	.....	.....	.....	.....	.....	.....	53,653	2,181
Synthetic rubber, S type	.....	.....	.....	.....	.....	.....	2,844	1,407	2,844	1,407
TOTALS	1,074,082	$ 274,985	2,148,198	$ 537,674	830,688	$ 246,468	1,176,089	$ 304,051	8,131,982	$ 2,115,423
MANUFACTURED										
Rubber soles, soling, toplift sheets ...lbs.	.....	.....	6,720	2,688	.....	.....	.....	.....	17,920	7,216
Drug sundries	.....	.....	.....	660	.....	.....	.....	.....	.....	660
Tires and casings ...no.	.....	.....	700	1,541	.....	.....	.....	.....	700	1,541
Compounded rubber for further manufacture ...lbs.	.....	.....	4,630	78,946	.....	.....	.....	.....	4,630	78,946
TOTALS	.....	.....	.....	$ 83,835	.....	.....	.....	.....	.....	$ 88,363
GRAND TOTALS, ALL RUBBER REEXPORTS	.....	$ 274,985	.....	$ 621,509	.....	$ 246,468	.....	$ 304,051	.....	$ 2,203,786

*For Jan., 1954, see our June, 1954, issue, p. 436; for Feb., 1954, see July, p. 576. Future reports will be on a six-month total basis only.

SOURCE: Bureau of the Census, United States Department of Commerce, Washington 25, D. C.

Totals for the First Half of 1954; March-June by Months*

	March		April		May		June		Six-Month Totals	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Imports for Consumption of Crude and Manufactured Rubber										
UNMANUFACTURED, LBS.										
Crude rubber	94,167,973	$15,823,475	98,991,356	$16,605,910	116,876,660	$19,493,956	134,642,174	$23,432,566	620,984,744	$105,485,721
Latex	12,727,338	3,031,963	12,684,400	2,855,180	8,525,977	1,907,249	14,760,845	3,515,531	73,509,878	16,938,477
Balata	42,549	22,053	292,537	64,025	201,549	35,350	194,841	36,745	966,400	207,525
Jelutong or Pontianak	131,270	73,541	506,248	312,654	431,474	232,496	711,410	392,687	2,166,047	1,161,088
Gutta percha	43,639	17,213	120,917	45,733	61,162	37,329	216,468	126,979	536,622	279,143
Synthetic rubber	2,090,113	539,403	2,731,708	713,291	2,357,053	609,236	2,502,592	642,790	13,414,178	3,533,030
Reclaimed rubber	174,012	14,324	67,200	3,528	296,109	23,654	347,331	22,502	1,305,669	96,426
Scrap rubber	1,740,993	106,061	2,062,364	104,495	1,331,641	54,863	2,228,612	76,380	11,239,210	498,045
TOTALS	111,117,887	$19,628,033	117,456,730	$20,704,816	130,081,625	$22,394,133	155,604,273	$28,246,180	724,122,748	$128,199,455
MANUFACTURED										
Rubber tires										
Auto, etc.....*no.*	5,981	$ 207,150	2,392	$ 125,775	3,494	$ 182,657	5,783	$ 230,477	28,629	$ 1,145,969
Bicycle.....*no.*	7,765	6,373	12,617	8,461	10,040	6,758	6,650	5,439	43,149	32,145
Other.....*no.*	866	30,000	20	302	871	12,333	7	2,309	1,767	45,262
Inner tubes: auto, etc...*no.*	1,133	3,153	770	4,237	2,859	12,292	671	6,466	6,354	28,711
Footwear										
Boots.....*prs.*	4,266	9,737	4,336	10,045	11,400	16,117	3,650	7,926	37,369	99,986
Shoes and overshoes..*prs.*	50,958	27,005	52,498	21,475	38,070	18,210	44,121	26,233	238,493	121,664
Rubber-soled canvas shoes.....*prs.*	3,460	3,370	3,110	3,946	5,363	3,493	4,042	2,514	22,015	17,806
Athletic balls										
Golf.....*no.*	108,336	28,006	192,192	46,283	51,480	13,680	61,272	16,209	611,520	155,289
Tennis.....*no.*	77,100	21,327	115,704	27,271	125,644	36,300	56,400	15,291	451,036	118,540
Other.....*no.*	93,816	11,405	63,360	8,006	5,294	1,300	6,660	848	352,550	42,468
Toys.....	.....	19,579	.....	46,387	.....	23,571	.....	32,880	.....	165,006
Hard rubber goods										
Combs.....*no.*	16,896	1,478	124,576	11,869	70,242	6,877	60,442	6,001	321,000	31,975
Other.....	.....	2,594	.....	2,594	.....	1,500	.....	3,810	.....	48,693
Rubber and cotton packing.....*lbs.*	1,389	2,840	5,868	10,132	3,236	5,442	3,431	6,407	24,031	42,343
Gasket and valve packing.	.....	16,432	.....	14,196	.....	4,173	.....	7,219	.....	57,086
Belting.....*lbs.*	823	1,114	25,564	19,887	3,801	2,502	10,409	8,942	52,305	43,632
Hose and tubing.....	.....	11,316	.....	35,786	.....	6,985	.....	17,764	.....	99,039
Gloves.....*prs.*	17,232	4,131	20,790	3,659	128,652	32,820	95,374	20,380	316,492	75,121
Nipples and pacifiers....*gr.*	2,775	3,518	5,950	6,529	300	520	7,105	8,622	18,050	21,842
Instruments.....*doz.*	5,916	14,175	8,518	19,860	2,559	18,152	5,050	11,533	27,099	77,409
Soles and heels.....*lbs.*	1,448	1,487	8,062	7,604	1,407	1,261	445	411	29,728	29,285
Other.....	.....	.....	.....	2,641	.....	3,265	.....	1,470	.....	9,462
Gutta percha manufactures..	2,075	2,193	1,400	1,251	3,375	3,444	1,762	2,947	13,187	14,515
Synthetic rubber products...	.....	1,201	.....	11,656	.....	17,541	.....	8,222	.....	50,735
Other soft rubber goods.....	.....	133,249	.....	225,464	.....	184,175	.....	169,491	.....	965,425
TOTALS	.....	$ 862,833	.....	$ 675,316	.....	$ 615,368	.....	$ 619,811	.....	$ 3,539,408
GRAND TOTALS, ALL RUBBER IMPORTS	.....	$20,190,866	.....	$21,380,132	.....	$23,009,501	.....	$28,865,991	.....	$131,738,863

Cotton Fabrics

(Continued from page 426)

Especially strong was the demand for unfinished drapery fabrics as converters again purchased substantial yardages of various drapery constructions for delivery as far ahead as next March. Heaviest trading took place in wide bark cloths and similar fabrics, and the supply of these goods was rapidly becoming tight for delivery in January and February. Leading producers were estimated to have sold about 60% of their production for the first quarter of 1955.

Observers noted that a number of industrial fabric mills had cut their production of wide drills sharply because of the unprofitable price levels at which these goods have been for some time. Wide drills and other woven fabrics for coating purposes have been in light demand for more than a year, and prices of these items have consequently been in sharp decline.

Price changes were few and of minor importance this month. Selling prices, f.o.b. shipping point on November 15:

Cotton Fabrics

Drills	
59-inch 1.85-yd.....*yd.*	$0.345 / $0.35
2.25-yd.....	.295 / .30
Osnaburgs	
40-inch 2.11-yd.....*yd.*	.24 / .2425
3.65-yd.....	.155
Raincoat Fabrics	
Printcloth, 38½-inch, 64x60, 5.35-yd.....*yd.*	.14
6.25-yd.....	.1175
Sheeting, 48-inch, 4.17-yd.....	.20
52-inch, 3.85-yd.....	.21
Ducks	
38 inch 1.78-yd. S.F.....*yd.*	nom.
2.00-yd. D.F.....	nom.
51.5-inch, 1.35-yd. S.F.....	nom.
Hose and belting.....	.67
Chafer Fabrics	
14.30-oz./sq. yd. Pl.....*lb.*	.73
11.65-oz./sq. yd. S.....	.65
10.80-oz./sq. yd. S.....	.6875
8.9-oz./sq. yd. S.....	.70
Other Fabrics	
Headlining, 59-inch, 1.65-yd., 2-ply.....*yd.*	.4625/ .465
64-inch, 1.25-yd., 2-ply.....	.595
Sateens, 53-inch, 1.32-yd.....	.535
58-inch, 1.21-yd.....	.585

RAYON

Total calculated production of rayon high-tenacity yarn by domestic producers during October was 27,700,000 pounds. Total shipments amounted to 30,000,000 pounds, about the same as for September, but 12% lower than in October of last year. Month-end stocks were noted at 8,700,000 pounds, a further decline from the peak of 19,000,000 held by producers at the end of August.

Total calculated rayon and acetate yarn production during this period amounted to 60,700,000 pounds. Shipments came to 64,900,000 pounds, 3% greater than in September, but a decline of 1% from last year's figure. Month-end stocks were 60,600,000 pounds.

Staple plus tow figures for both rayon and acetate were unavailable.

No price changes were in evidence for rayon tire yarn and fabrics during the period from October 16 to November 15.

Rayon Prices

Tire Yarns	
High Tenacity	
1100/ 480.....	$0.62 / $0.63
1100/ 490.....	.62
1150/ 490.....	.62
1165/ 480.....	.63
1230/ 490.....	.62
1650/ 720.....	.61
1650/ 980.....	.61
1875/ 980.....	.61
2200/ 960.....	.60
2200/ 980.....	.60
2200/1466.....	.67
4100/2934.....	.63
Super High Tenacity	
1650/ 720.....	.64
1900/ 720.....	.64
Tire Fabrics	
1100/490/2.....	.72
1650/980/2.....	.695 / .73
2200/980/2.....	.685

Plasticizer Color Specifications Lowered

The plasticizer division, Pittsburgh Coke & Chemical Co., Pittsburgh, Pa., has announced a reduction in the maximum APHA color specifications for its DOP/DIOP plasticizers from 50 to 25. According to the firm, complete quality control makes possible a purer raw material for customer requirements.

RUBBER HARDNESS

THE LANGUAGE OF THE RUBBER INDUSTRY SINCE 1915

DUROMETER

VARIOUS MODELS FOR TESTING THE ENTIRE RANGE

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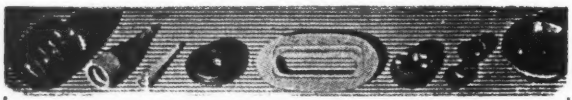

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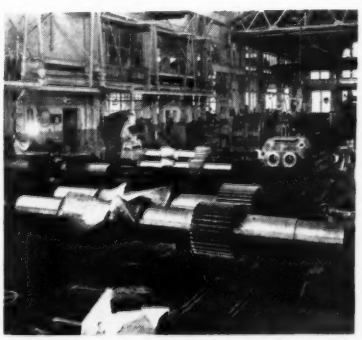

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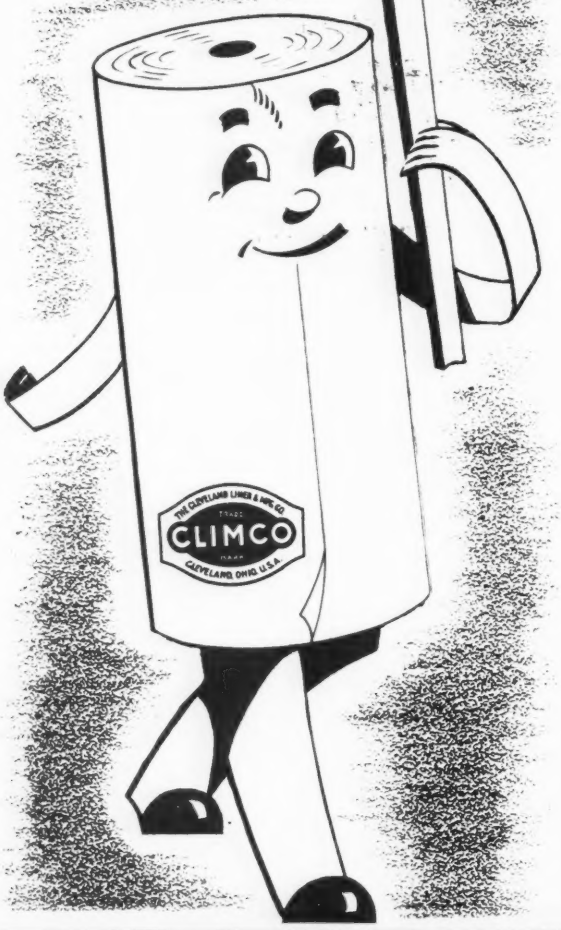

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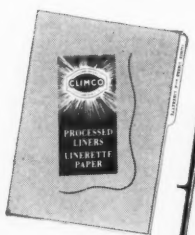

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